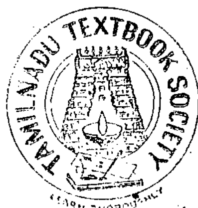
# MATHEMATICS 6




TAMILNADU TEXTBOOK SOCIETY

# MATHEMATICS

## STANDARD VI




TAMILNADU
TEXTBOOK SOCIETY
MADRAS

C Government of Tamilnadu
First Edition—1981
Reprint—1982

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**Price : Rs. 3-50**

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|---|
| This book has been printed on concessional paper of 60 G. S. M. Substance made available by Government of India. |

Printed by:
ELANGOVAN PRINTERS, Madras-600 014.

# CONTENTS

# 1. WHOLE NUMBERS

## 1-1 Number System:

Let us recall what you have learnt in the previous classes. In the ten base system any number can be written using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 by giving proper values to places. This system was invented by the Hindus. This system is therefore known as the **Hindu System** of Numerals. Later the Arabs passed on this system to the Western countries. Therefore, it is also referred to as the **Indo-Arabic system.**

Every number has got a **name and a symbol.**

**Example :**

| Number Name | Numeral Symbol |
|---|---|
| Zero | 0 |
| One | 1 |
| Six | 6 |
| Sixtyfive | 65 |
| A hundred | 100 |
| One thousand eight hundred eighteen | 1,818 |

## 1-2

When we count the number of objects in a collection, we start with 1 and count 1,2,3,4,5,...... and so on. These numbers are called counting numbers. They are known as Natural Numbers (N). If we include zero also we get the **Whole Numbers (W).**

Natural Numbers : 1,2,3,4,5,......
Whole Numbers : 0,1,2,3,4,5,......

1-3

We use the denary system of numeration in our daily life. In large collections, objects are counted in groups of tens. After grouping them into tens, anything left out and less than ten are termed **ones.** These groups of tens may again be grouped in "tens of tens."

Groups of tens of tens are named **hundreds**. The rest which cannot form a complete hundred are left as **tens.** Thus we can go on to **thousands, ten thousands, lakhs, ten lakhs, crores** and so on. Remember the following :

| | |
|---|---|
| 1 | one |
| 10 | Ten |
| 100 | Hundred |
| 1,000 | Thousand |
| 10,000 | Ten Thousand |
| 1,00,000 | Lakh |
| 10,00,000 | Ten Lakh |
| 1,00,00,000 | Crore |

1-4 **Two values of numbers** :

Note the position of 3 in the following numbers.

* 4,273; * 4,237; * 4,327; * 3,472.

The **face value** of 3 is 3

But it has a **place value** which depends on its position. In 4273, 3 occupies the one's place and its place value is three ones. In 4237, 3 occupies the ten's place and its place value is three tens. In 3472, 3 occupies the thousand's place and its place value is three thousands.

The face value and the place value of zero are both 0.

(e. g.) In the number 408, '0' tells there are no tens.

1-5

We write numbers in two different systems viz., the Indian system and the British system. Upto Ten thousand, there is no difference between these two systems. In the Indian system we

proceed further thus: lakh, ten lakh, crore, ten crore and so on. In the British system we proceed in the following manner: hundred thousand, million, ten million and so on.

Observe the following Table carefully :

| The Indian system | Crore | Ten lakh | Lakh | Ten thousand | Thousand | Hundred | Ten | One |
|---|---|---|---|---|---|---|---|---|
| No | 2 | 7 | 4 | 3 | 5 | 6 | 1 | 8 |
| The British system | Ten Million | Million | Hundred Thousand | Ten Thousand | Thousand | Hundred | Ten | One |

The name of the number in the Indian system is: Two crore, seventy four lakh, thirty five thousand, six hundred eighteen.

The name of the number in the British system is: Twenty seven million, four hundred thirty five thousand, six hundred eighteen.

In the universal system, numbers are written grouping digits in threes and leaving space between them.
(e.g.) 8, 415; 3, 625, 479.

### 1-6 Powers and Multiples :

In the denary system of numeration, place value can be written as powers of ten.

| | | | |
|---|---|---|---|
| 10 | = | $10^1$ | (First power of ten) |
| 100 | = | 10 X 10 $\quad 10^2$ | (Second power of ten) |
| 1,000 | = | 10 X 10 X 10 $\quad 10^3$ | (Third power of ten) |
| 10,000 | = | 10 X 10 X 10 X 10 $\quad 10^4$ | (Fourth power of ten) |

and so on.

Consider the following numbers.

10, 20, 30, 40, .............. 90, 100, 110, . .. ..... These are multiples of 10.

$20 = 2 \times 10$ (2 times of 10)
$30 = 3 \times 10$ (3 times of 10)
$100 = 10 \times 10$ (10 times of 10)

**Note**: Every power of a certain number can be expressed as a multiple of that number. But certain multiples of number alone can be written as a whole number power of that number.

**1-7**

The **expanded notation** of a whole number can be written using exponents.

(e. g.) $8{,}415 = 8000 + 400 + 10 + 5$
$= 8 \times 1000 + 4 \times 100 + 1 \times 10 + 5$
$= 8 \times 10^3 + 4 \times 10^2 + 1 \times 10^1 + 5$

8,415 is called the **standard numeral**.
$8 \times 1000 + 4 \times 100 + 1 \times 10 + 5$ is its **expanded notation**.
$8 \times 10^3 + 4 \times 10^2 + 1 \times 10^1 \times 5$ is its
**expanded exponential notation.**

The given number can be written either in expanded exponential notation or in the expanded notation.

(e. g.) $3 \times 10^3 + 4 \times 10^2 + 2 \times 10^1 + 6 = 3{,}426$
$6{,}000 + 300 + 40 + 7 = 6{,}347$

**Note**: If there is no power of ten in a place in the expansion, that place is indicated by '0'.

(e. g.) $5{,}038 + 5 \times 10^3 + 0 \times 10^2 + 3 \times 10^1 + 8$

**Exercise 1-1**

1. **Read the following as in the Indian System**:

(a) 605 (b) 1,892 (c) 9,999 (d) 90,608 (e) 3,70,216
(f) 26,72,305 (g) 1,02,30,074

2. Read the following as in the British System :

(a) 315,147 (b) 208,214 (c) 1,310,310 (d) 24,070,089

3. Write the numerals for :

(a) One crore, nine lakh, eighty two thousand, one hundred four.

(b) Nine lakh, ninety nine thousand, nine hundred ninety nine.

(c) Ten thousand, ten.

(d) Three lakh, four thousand, forty nine.

(e) Forty lakh, seventy thousand, nine hundred eight.

(f) Ninety eight lakh, seventy six thousand, five hundred forty three.

(g) One million, eight thousand, twelve.

(h) One million, six hundred four thousand, six hundred ten.

4. What are the place values of the star marked digits (in the British system).

(a) $7,0\dot{8}4$ (b) $8\dot{5},376$ (c) $\dot{1}23,369$

(d) $3\dot{7}2,018$ (e) $3,\dot{6}24,805$ (f) $2,03\dot{9},570$

5. (a) In the number 826, '0' is inserted between 2 and 6. Which are the digits that get changed in place value? How do they get changed?

(b) In the zeros in the number 60,504 are removed, which digits get changed in place value? How do they get changed?

(c) Write the greatest number with six digits. Find the number which when added to this, gives the least number with seven digits.

(d) Find the difference between the greatest number with 5 digits and the greatest number with 4 digits.

6. Complete the sentences :

(a) 300 is —— times 10

(b) 1,000 is —— power of 10

(c) 10,000 is —— power of 10

(d) 1,800 is —— times 10

(e) 100 is —— times 10

(f) 1,00,000 is —— power of 10

(g) 10 is —— times 10

7. Write in the expanded notation :

(a) 24,185 (b) 35,764 (c) 41,046
(d) 30,465 (e) 50,428 (f) 18,709

8. Write in the expanded exponential notation :

(a) 36,248 (b) 71,283 (c) 24,071 (d) 30,465
(e) 28,702 (f) 45,038

9. Write the following in standard numerals :

(a) $6{,}000+300+40+9$ (b) $20{,}000+5{,}000+200+70+6$
(c) $30{,}000+300+3$.

10. Write the following in standard numerals:

(a) $5 \times 10^5 + 6 \times 10^4 + 3 \times 10^3 + 7 \times 10^2 + 2 \times 10^1 + 4$

(b) $3 \times 10^4 + 8 \times 10^3 + 7 \times 10^2 + 6 \times 10^1 + 5$

(c) $6 \times 10^5 + 7 \times 10^3 + 3 \times 10^1 + 9$

(d) $8 \times 10^6 + 7 \times 10^5 + 5 \times 10^3 + 2 \times 10^1 + 3$

### 1-8 Order in numbers :

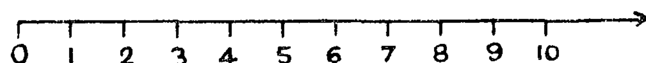



Fig. 1-1

Observe the number ray given above. In this the whole numbers are marked in order from left to right. If we proceed from left to right, the number increases in value. On the contrary if we proceed from right to left, the value of the number decreases.

In this number ray; all the numbers are **greater** than 0. All the numbers which are to the right of 5 are greater than 5 and the numbers to the left of 5 are **smaller** than 5.

(e. g.) 6, 7, 8, 9, 10, are to the right of 5 and are greater than 5.

4, 3, 2, 1, 0 are to the left of 5 and are smaller than 5.

The **successors** of a whole number is the number immediately next to the right of the given number on the number ray. The **predecessor** of a whole number is the number immediately next to the left of the given number on the number ray.

(e. g.) The predecessor of 7 is 6; the successor of 7 is 8.

The predecessor of 100 is 99, the successor of 100 is 101.

### 1-9

56 is greater than 48. We write $56 > 48$.

"$>$" stands for 'is greater than' Similarly 48 is less than 56. In symbol, we write $48 < 56$. "$<$" stands for 'is less than'.

### 1-10

Any set of numbers can be arranged starting from the least and ending with the greatest. This is called "arranging numbers in the **ascending order**".

(e. g.) Write in the ascending order. 841; 1,025; 10,172; 728; 2,036.

The smallest number is 728 and the greatest is 10,172. In the ascending order the numbers are written as 728; 841; 1,025; 2,036; 10,172.

Similarly, the given numbers can be arranged, starting from the greatest number and ending with the least number. This is called "arranging the numbers in the **descending order**".

(e. g.) The same numbers written in descending order will be in the following order. 10,172; 2,036; 1,025; 841; 728.

**Exercise 1.2**

1. State whether the following statements are true or false.

(a) $54 > 38$, (b) $9 > 11$, (c) $6 = 6$.
(d) $10 < 15$, (e) $21 < 19$, (f) $25 < 21$.

2. Complete the following using either "to the right" or "to the left" in the number ray.

(a) 8 is —— of 12. (b) 16 is —— of 9.
(c) 99 is —— of 100, (d) 201 is —— of 199.

3. Complete the following with the suitable symbol : $( > , < )$ so as to make the sentences true.

(a) 6 ...... 8 (b) 111 ...... 101 (c) 200 ...... 199
(d) 899 ...... 900

4. Write in the ascending order of numbers :

(a) 6,042; 872; 24,001; 13,798; 15
(b) 5,678; 5,768; 5,876; 5,687; 5,786
(c) 12,181; 10,000; 9,999; 10,565; 7,777

5. Write in the descending order of numbers :

| | | | | | |
|---|---|---|---|---|---|
| (a) | 456; | 7,089; | 12,410; | 6,139; | 762 |
| (b) | 3,952; | 3,592; | 3,259; | 3,295; | 3,529 |
| (c) | 10,234; | 12,356; | 9,324; | 9,898, | 11,247 |

6. Write the greatest number and the least number that can be formed with the following digits.

(a) 6, 2, 0, 4, 3 (b) 7, 2, 8, 1, 5

(c) 3, 5, 7, 0, 2 (d) 9, 8, 7, 0, 6

7. Write the predecessor and successor of each of the following numbers:

(a) 101 (b) 999 (c) 198 (d) 222

**1-11 Addition in whole Numbers:**

You have already learnt to add numbers. Addition can be easily represented through a number ray.

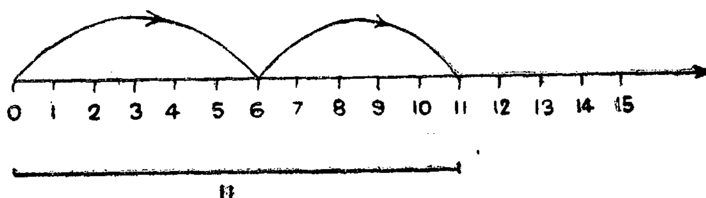



**Fig. 1-2**

Each point in a number ray denotes a number. Let us add 5 to 6. We start from 0. Move 6 points in the number ray to reach 6. Move further 5 points in the same direction. We reach 11. Thus we find 6 + 5 equal to 11.

**Properties of Addition :**

1. When two whole numbers are added, they can be taken in any order. (e. g.) 7 + 5 = 5 + 7 = 12.

2. Any three whole numbers can be added in any of the following ways. (e. g.) (6 + 4) + 5, 6 + (4 + 5), 6 + (5 + 4), (6 + 5) + 4, (5 + 6) + 4, (5 + 4) + 6, 5 + (4 + 6), (4 + 6) + 5, 4 + (6 + 5), (4 + 5) + 6, 4 + (5 + 6).

(i. e.) We add any two of the three numbers and add the third number to the sum of the two numbers.

3. Any four whole numbers can be added using the above two properties. We can rearrange the numbers in any way and then find their sum.

(e. g.) $8 + 4 + 2 + 6$ $\quad (8 + 2) + (6 + 4)$

$(2 + 8) + (4 + 6)$

$(8 + 2 + 6) + 4$

$(4 + 6 + 8) + 2$

All these have the same sum.

4. If a whole number is added to zero or if zero is added to a whole number, the same number is got.

(e. g.) $6 + 0 = 6$; $0 + 5 = 5$

5. We can add the whole numbers using the expanded form of numerals.

(e. g.)
$$\begin{aligned} 452 + 369 &= 400 + 50 + 2 + 300 + 60 + 9 \\ &= 400 + 300 + 50 + 60 + 2 + 9 \\ &= 700 + 110 + 11 \\ &= 700 + 100 + 10 + 10 + 1 \\ &= 800 + 20 + 1 \\ &= 821. \end{aligned}$$

6. A whole number can be written as the sum of 2, 3 or 4 whole numbers:

(e. g.) $8 = 5 + 3$; $10 = 5 + 2 + 3$; $16 = 7 + 3 + 5 + 1$

This is what is known as renaming of the whole numbers.

### Exercise 1-3

1. Write down the addition facts marked on the number ray.

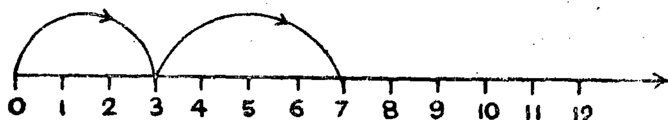



Fig. 1-3

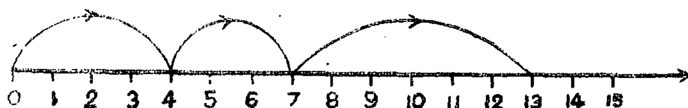



Fig. 1-4

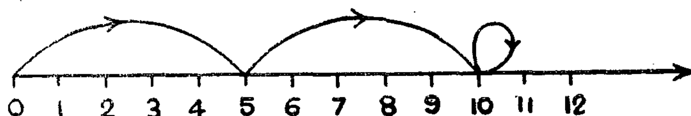



Fig. 1-5

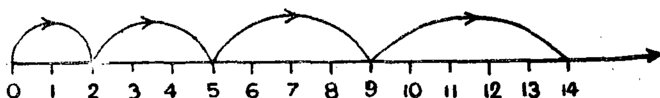



Fig. 1-6

2. Show each of the following addition facts on a number ray.

   (a) $7 + 5 = 12$ (b) $6 + 4 + 10$ (c) $10 + 6 = 16$

   (d) $8 + 0 = 8$ (e) $0 + 3 = 3$.

3. State whether the following are true or false.

   (a) $9 + 5 + 3 = 9 + (5 + 3) = (9 + 5) + 3$

   (b) $10 + 6 + 8 + 2 = (10 + 6) + (8 + 2)$

   $= (10 + 8) + (6 + 2)$

4. Do the following addition using the expanded notation :

   (a) $536 + 728$ (b) $485 + 379$ (c) $914 + 286$

5. Express 16 as a sum in 5 different ways.

## Exercise 1-4

**Add :**

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| 4958 | 64 | 8094 | 112108 |
| 765 | 765 | 3205 | 25963 |
| 3263 | 8 | 2008 | 33427 |
| 41 | 1294 | 470 | 623 |
| 14376 | 987 | 13075 | 30086 |

| (5) | (6) |
|---|---|
| 234078 | 517234 |
| 146505 | 108310 |
| 27888 | 57608 |
| 406213 | 79215 |
| 999 | 263721 |

7. Write the 4 consecutive numbers following 3,568. Add these 4 numbers with 3,568.

8. Form five four digit numbers using the digits 6, 7, 0 and 8. Add them.

9. Ravi had Rs. 84. His sister Uma had Rs. 25 more than Ravi. Her elder brother Mani had Rs. 32 more than Uma. Find how much each had and find the total amount they had all together.

10. The cost of a radio is Rs. 846. The cost of a television set is Rs. 2462 more than the cost of the radio. Find the cost of television. What is the total cost ?

11. The attendance of pupils of a school on a day is as follows :

Sections

| Standard | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 6 | 36 | 34 | 40 | 41 | 42 | 38 |
| 7 | 38 | 39 | 40 | 35 | 38 | |
| 8 | 40 | 42 | 43 | 39 | | |

(i) Find out the total attendance of each of the standards on that day.

(ii) Find out the total number of pupils who attended the school on that day.

**1-12 Subtraction in Whole Numbers :**

Subtraction means taking away a number from another number.

Subtraction on number ray :

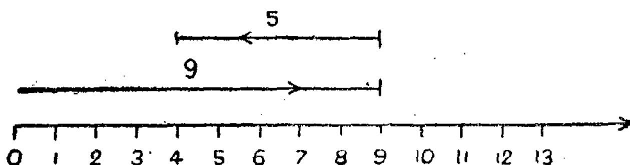



Fig. 1-7

Let us subtract 5 from 9. Move from 0 to 9. Then from 9, move back by 5 points. We reach 4. Therefore $9-5=4$.

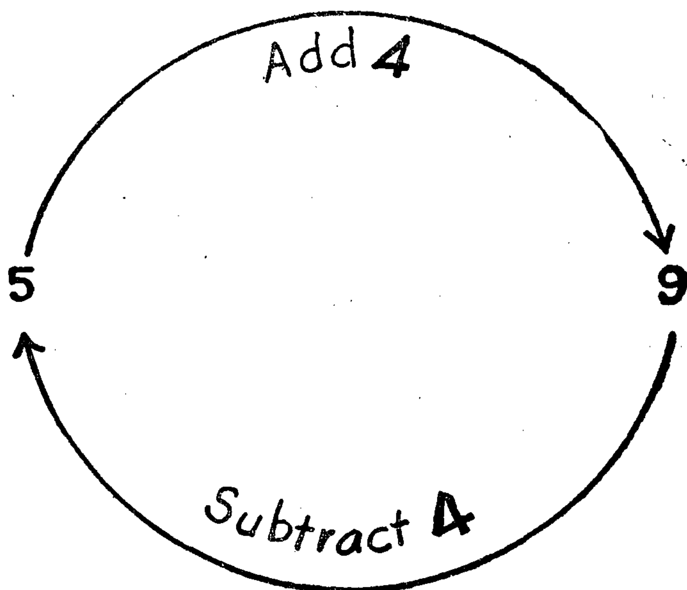



Fig. 1-8

$5 + 4 = 9$

$9 - 4 = 5$

It is therefore clear that addition and subtraction may be considered as opposite operations.

(a) With every addition fact, two subtraction facts are associated.

(e. g.) Associated with $7+4=11$, We have the two subtraction facts $11-4=7$ and $11-7=4$.

(b) If we subtract '0' from any number, we will get the same number

(e. g.) $5-0=5$; $10-0=10$

## Exercise 1-5

1. Give two subtraction facts for each of the following addition facts.

   (a) 8+4=12 (b) 36+64=100
   (c) 40+85=125 (d) 70+50=120

2. Write down the subtraction facts marked on the number ray.

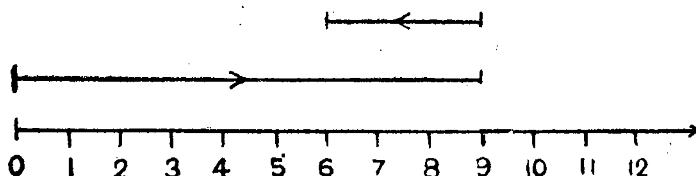



Fig. 1-9

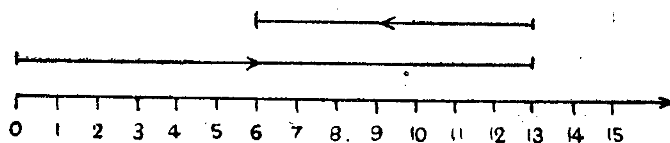



Fig. 1-10

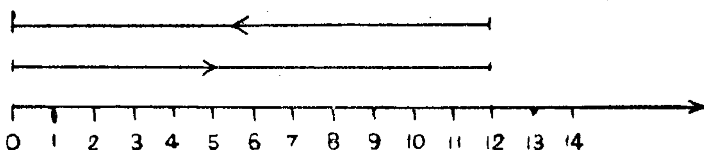



Fig. 1-11

3. Illustrate each of the following subtraction facts on a number ray.
   a) 12—5=7 b) 16—8=8 c) 9—3=6 d) 5—5=0

**Subtract :**

| (4) | (5) | (6) |
|---|---|---|
| 7484 | 42071 | 126352 |
| 2896 | 34768 | 98647 |

(7) 987467
269672

(8) 907065
370672

(9) 1000000
123456

10. In a school, 605 students are studying in Standard VI and 489 students are studying in Standard VII. Find the difference in strength.

11. Using 6, 0, 7, 2, 3, write down the greatest number and the least number. Find their difference.

12. A man wants to buy a house for Rs, 60,000. He has only Rs. 48,965.. How much more money does he require to buy the house?

13. In 1961 the population of a place was 2,16,374. In 1971 the population of that place was 2,72,036. Find the increase in population.

14. Four candidates contested an election. The number of votes each got were as follows:

22,419; 21,269; 10,146; 5,971. By how many votes did the successful candidate defeat each of the other candidates?

15. Find the whole number which when added to 65,964 gives 1 lakh.

**1-13 Combination of Addition and Subtraction:**

(a) In problems involving addition and subtraction, first find the total of the whole numbers to be added up; then find the total of the whole numbers that are to be subtracted; finally find the difference between the first sum and the second sum.

(e. g.) $25-32+45+15-22=(25+45+15)-(32+22)$
$=85-54=31$.

(b) If there are any brackets, simplify those whole numbers within the brackets first and then do the addition or subtraction as the case may be.

(e. g.) (8—7)+3=1+3=4; 15—(7—3)=15—4=11.

**Exercise 1-6**

Simplify :

(1) 24—13+16—72+104

(2) 1635+2394—4891+3008

(3) 10000—4127—2147—155

(4) 9218—2346—4719+381

5. Add the following 4 numbers : 8,256; 3,172; 2,018; 11,205. Subtract their total from 40,000.

Fill in the suitable digit in "*" place in the following:

| | | | |
|---|---|---|---|
| 6. | 8101 | (7) | 6*872 |
| | 4578 | | *8563 |
| | 34663 | | 41*7* |
| | 1056 | | 67924 |
| | ***** | | |
| | 115042 | | 221629 |

8. A man deposited Rs. 875, Rs. 2,146 and Rs. 925. He withdrew Rs. 674, and Rs. 1,892. Find the balance amount in the bank.

9. Simplify : (a) (15—6)—8 (b) 18—(7—1)
(c) (20—8)—3 (d) 25—(25—11)

10. A cart costs Rs. 896 and a horse costs Rs. 684 more than the cart. Find the total cost.

11. The cost of a car is Rs. 28,746. The scooter costs Rs. 21,892 less than the car. Find the cost of the scooter. What is the total cost?

2. The population of a town is 42,376. Of these 21,328 are males. How many females are there? Find the difference.

## 1-14 Multiplication in Whole Numbers :

The figure above explains that $4 \times 3 = 12$. This can be considered as jumping forward four times at the rate of 3 steps per jump.

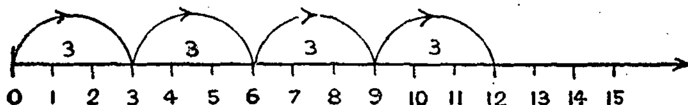



Fig. 1-12

In the above problem $3+3+3+3$ is considered as $4 \times 3 = 12$. So we may consider multiplication as **repeated addition.**

**Properties of multiplication :**

(a) (e. g.) $5 \times 7 = 7 \times 5 = 35$.

Therefore, when two numbers are to be multiplied, they can be taken in any order.

(b) If a whole number is multiplied by zero, or if zero is multiplied by a whole number, we get zero as their product.

(e. g.) $4 \times 0 = 0$; $0 \times 7 = 0$,

(c) Consider the following example.
$8 \times 6 \times 5 = 8 \times 5 \times 6 = 6 \times 5 \times 8 = 240$.

Thus, while multiplying 3 or more whole numbers, the numbers can be arranged in any order.

(d) Note the following examples.

$$21 \times 16 = 21 \times (10+6) = 21 \times 10 + 21 \times 6$$
$$= 210 + 126$$
$$= 336,$$

$264 \times 12 = (200+60+4) \times 12$
$= 200 \times 12 + 60 \times 12 + 4 \times 12$
$= 2400 + 720 + 48$
$= 3168.$

Therefore we can write one of the numbers in expanded notation and then multiply the same by the other number.

(e) If you want to multiply different whole numbers by a whole number and find their sum, you first add the different whole numbers and find the product with the given whole number.

(e. g.) $= 8 \times 6 + 7 \times 6 + 10 \times 6$
$= (8+7+10) \times 6 = 25 \times 6 = 150$
Verify if this is true.

(f) If you multiply any number by 1 or multiply 1 by any number, you will get the same number as their product.
(e. g) $7 \times 1 = 7$; $1 \times 7 = 7$.

(g) (i) If you want to multiply any number by 9, multiply the number by 10 and then subtract the number from the product.
(e. g.) $54 \times 9 = 54 \times (10-1) = 54 \times 10 - 54$
$= 540 - 54 = 486.$

(ii) To multiply any number by 99, multiply the number by 100 and then subtract the number from the product.
$54 \times 99 = 54 \times (100-1) = 54 \times 100 - 54$
$= 5400 - 54 = 5346$

(iii) To multiply any number by 999, multiply the number by 1,000 and then subtract the number from the product.
(e. g.) $54 \times 999 = 54 \times (1000-1) = (54 \times 1000) - 54$
$= 54000 - 54 = 53946$

(h) (i) To multiply a given number by 11, multiply the number by 10 and then add that number to the product.
(e. g.) $54 \times 11 = 54 \times (10+1) = (54 \times 10) + 54$
$= 540 + 54 = 594$

(ii) To multiply a given whole number by 101, multiply the number by 100 and then add the number to the product.

(e. g.) $54 \times 101 = 54 \times (100 + 1) = 54 \times 100 + 54$
$= 5400 + 54 = 5454$

Find out the rule for multiplication by 1,001

**Exercise 1·7**

1. State the multiplication facts associated with the following illustrations.

(a)

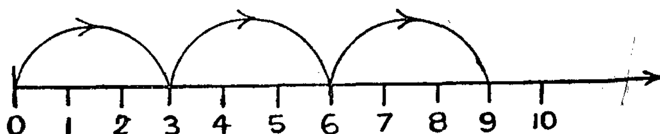



Fig. 1·13

(b)




Fig. 1·14

(c)

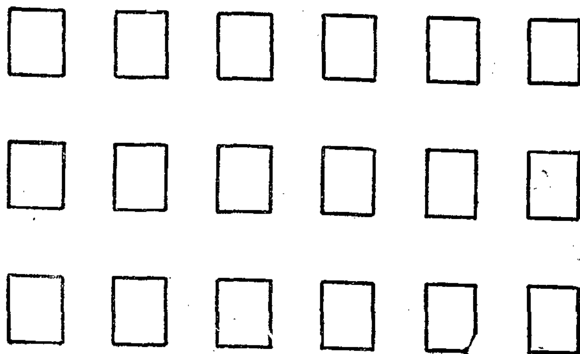


Fig. 1·15

(d)

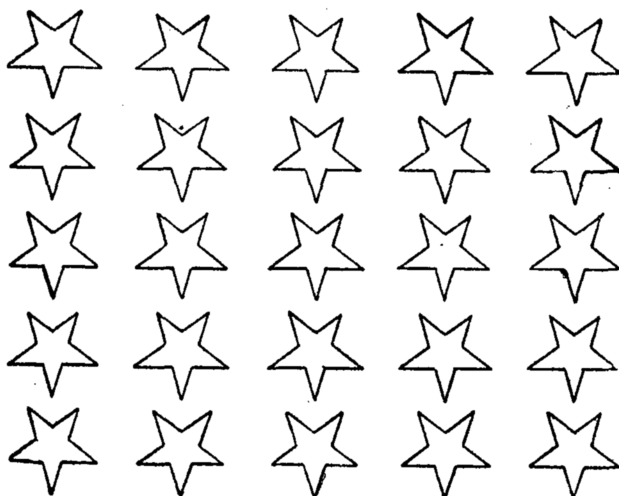


Fig. 1-16

(e)

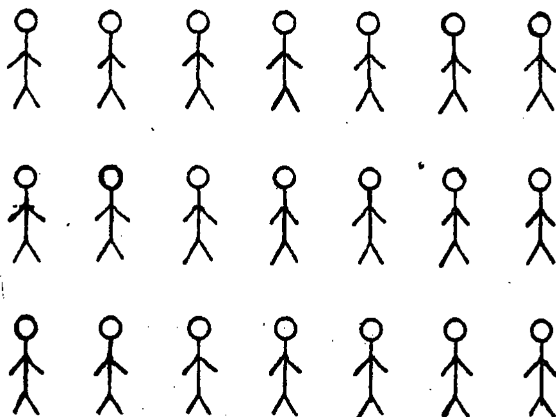


Fig. 1-17

(f)

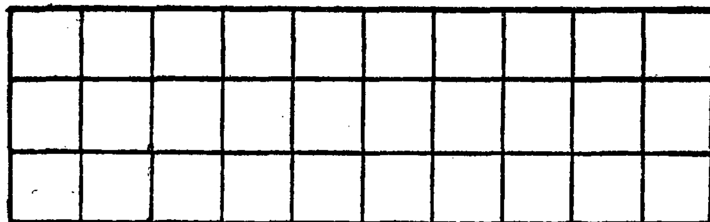


Fig. 1-18

2. State whether the following statements are true or false:

(a) $5 \times 8 \times 4 = 4 \times 8 \times 5$

(b) $6 \times 0 = 6$

(c) $32 \times 15 = 32 \times (10 + 5)$

(d) $24 \times 15 = 24 \times 10 + 24 \times 5$

(e) $4 \times 13 + 4 \times 7 + 4 \times 5 = 4 \times 25$

(f) $9 \times 1 = 9$

(g) $18 \times 12 = 18(10 + 2)$

3. State the following as multiplication facts:

(a) $8 + 8 + 8 + 8 + 8 = 40$

(b) $0 + 0 + 0 + 0 + 0 = 0$

(c) $5 = 5$

(d) $1 + 1 + 1 + 1 + 1 + 1 = 6$

4. Find the products using short-cut methods.

(a) $65 \times 9$ (b) $78 \times 99$ (c) $124 \times 999$

5. Find the product using short-cut methods:

(a) $84 \times 11$ (b) $163 \times 101$ (c) $132 \times 1001$

6. $8 = 10 - 2$, $98 = 100 - 2$, $998 = 1000 - 2$. Using these find the following products by short-cut methods.

(a) $56 \times 8$ (b) $67 \times 98$ (c) $105 \times 998$

7. $12 = 10 + 2$, $102 = 100 + 2$, $1002 = 1000 + 2$. Using these obtain the following products by short-cut methods.

(a) $104 \times 12$ (b) $68 \times 102$ (c) $73 \times 1002$

8. Simplify, using short-cut methods:

(a) $56 \times 8 + 32 \times 8 + 8 \times 8$

(b) $15 \times 12 + 34 \times 12 + 12$ (Note: $12 = 1 \times 12$)

(c) $38 \times 9 + 62 \times 9$

## Exercise 1·8

Find the value of

1. $784 \times 57$
2. $2358 \times 139$
3. $1903 \times 1029$
4. $2345 \times 896$

5. A man has 8 one hundred rupee notes, 21 ten rupee notes, 36 five rupee notes, 83 two rupee notes and 19 one rupee notes. Find the total amount.

6. A student was asked to multiply 1,872 by 56. But he multiplied 1,872 by 65. Find the difference.

7. A man has Rs. 10,000. He purchased 54 shares each selling at Rs. 128. Find the net amount he had after the purchase.

8. A merchant had Rs 58,376. He bought 36 radio sets each selling at Rs. 1,375. Find the net amount he had after the purchase.

9. A co-operative housing society decides to build 12 houses each at a cost of Rs. 24,125, 21 houses each at a cost of Rs. 28,720, and 15 houses each at a cost of Rs. 42,675. What will be the total value of all the buildings?

10. The bricks in a kiln were loaded in 183 carts at the rate of 625 bricks a cart. There were still 2,167 bricks left in the kiln. Find the total number of bricks made in the kiln.

### 1·15 Division in Whole Numbers :

Division may be illustrated on a number ray by jumping from right to left.

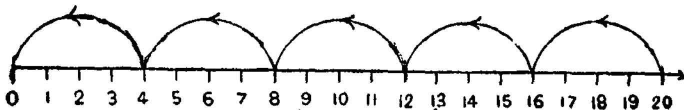



Fig. 1·19

To find $20 \div 4$, we start at 20 and jump 4 points at a time until we reach 0.

We go through 16, 12, 8, 4 and 0. We take 5 jumps to reach zero. So, $20 \div 4 = 5$

Each jump denotes a subtraction of 4. Therefore division may be considered as repeated subtraction.

Corresponding to every division fact there is one multiplication fact.

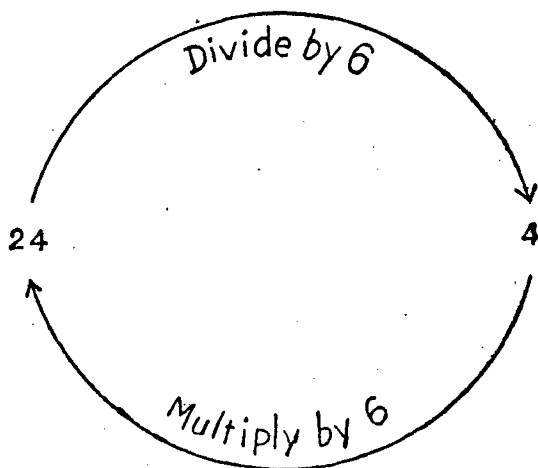



Fig. 1-20

(e.g.) $24 \div 6 = 4$. Corresponding to this division, $4 \times 6 = 24$ is the multiplication fact.

From this it is clear that multiplication and division may be considered as opposite operations.

**Properties of division :**

a) Corresponding to every multiplication fact, two division facts can be written.
(e.g.) $4 \times 5 = 20$
Corresponding to this, we have $20 \div 5 = 4$ and $20 \div 4 = 5$

b) If zero is divided by a non-zero number, the answer is 0,
(e. g.) $0 \div 5 = 0$; $0 \div 8 = 0$

But division by zero is not allowed in arithmetic.
(i. e.) Zero can be divided, but zero cannot divide.

(c) If any number is divided by 1, the answer is the same number.

(e. g.) $27 \div 1 = 27$

(d) Dividing 17 by 5 means casting out fives from 17. After casting out 3 fives we arrive at 2. This is shown on the number ray given below.

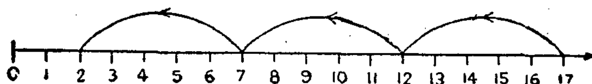



Fig. 1-21

17 is called the dividend, 5 is called the divisor, 3 is called the quotient and 2 is called the remainder.

$$17 = 3 \times 5 + 2$$

Dividend = Quotient × Divisor + Remainder

(e) (i) To divide a whole number by 5, multiply that whole number by 2 and divide that product by 10. Divide the remainder by 2.

(ii) To divide a whole number by 25, multiply that whole number by 4 and divide that product by 100. Divide the remainder by 4.

(iii) To divide a whole number by 125, multiply that whole number by 8 and divide that product bv 1,000. Divide the remainder by 8.

(iv) To divide the whole number by 625, multiply that whole number by 16 and divide that product by 10,000. Divide the remainder by 16

(e. g.) (i) $3728 \div 5 = 3728 \times 2 \div 10 = 7456 \div 10$
$= 745$ Quotient, Remainder $\frac{6}{2} = 3$

(ii) $3728 \div 25 = 3728 \times 4 \div 100 = 14912 \div 100$
$= 149$ Quotient, Remainder $\frac{12}{4} = 3$

(iii) $3728 \div 125 = 3728 \times 8 \div 1000 = 29824 \div 1000$
$= 29$ Quotient, Remainder $\frac{824}{8} = 103$

(iv) $3728 \div 625 = 3728 \times 16 \div 10000 = 59648 \div 10000$
$= 5$ Quotient, Remainder $\frac{9648}{16} = 603$

## Exercise 1-9

1. State the division facts illustrated on the number rays.

a.




Fig. 1-22

b.

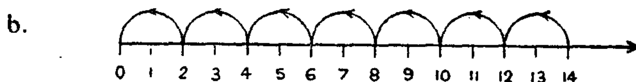



Fig. 1-23

2. Find the dividend, divisor, quotient and remainder using the illustration on the following number rays.

a.




Fig. 1-24

b.

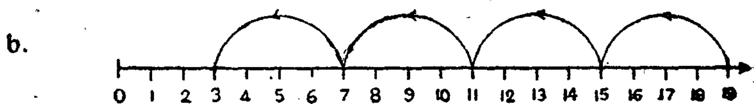



Fig. 1-25

3. Give the multiplication facts related to each of the following division facts.

(a) $18 \div 6 = 3$ (b) $54 \div 9 = 6$ (c) $99 \div 11 = 9$ (d) $81 \div 9 = 9$

4. Give two division facts related to each of the following multiplication facts.

(a) $7 \times 5 = 35$ (b) $13 \times 7 = 91$ (c) $12 \times 9 = 108$ (d) $16 \times 15 = 240$

5. In a division, the divisor is 12, quotient is 6 and the remainder is 3. Find the dividend.

6. Divide 175 by 11. Find the dividend, divisor, quotient and remainder.

7. Divide, using short-cut methods.

(a) $5324 \div 25$ (b) $6781 \div 125$

(c) $12398 \div 625$ (d) $1026 \div 5$

### Exercise 1-10

Find the value of

1. $43722 \div 126$
2. $1250416 \div 248$
3. $874248 \div 876$
4. $196343 \div 49$
5. $278609 \div 96$
6. $907532 \div 341$

7. Find the number which when divided by 362 yields 208 as quotient and 249 as remainder.

8. A pencil factory produced 35,893 pencils. They were packed into packets of 144. Find the number of packets and the number of pencils that remain loose.

9. A school got a grant of Rs. 20,000. The school made 72 desks using that money Rs. 200 was left over. What is the cost of each desk?

10. What is the least number to be added to 13,091 so that it may be divisible by 317?

11. A load of 800 kg. can be put into a cart. How many boxes can be loaded if each box weighs 5 kg.500 gm?

12. 2 m 15 cm length of cloth is required to make a shirt. Out of 20 m of cloth how many shirts can be made? What is the length of the cloth remaining?

(Note : Convert all the units to the same denomination)

**1·16. Problems involving the four operations :**

A number expression may contain all or any of the following symbols : $+$, $-$, $\times$, $\div$, ( ).

To simplify the expression,

1. First simplify the numbers within the brackets.
2. Do either multiplication or division in the order,
3. Finally do addition and subtraction operations.

(e. g.) Simplify : $120 \div 6 + 5\,(12 - 8 + 1) - 8$

$= 120 \div 6 + 5\,(4 + 1) - 8$ (Remove bracket)

$= 120 \div 6 + 5 \times 5 - 8$ (Do multiplication)

$= 120 \div 6 + 25 - 8$ (Do division)

$= 20 + 25 - 8$ (Do addition)

$= 45 - 8$ (Do subtraction)

$= 37$

**Exercise 1·11**

Simplify :
1) $20 + 5 \times 8 - 36$
2) $7 \times 8 - 4 \times 3$
3) $100 - 24 \times 3 \div 12$
4) $4 \times 9 + 7 \times 6 + 11 \times 5 - 8 \times 9$

5) $77 \div (12-9+4)+(24-13)-9$

6) $108 \div (20+7-15)-4 \times 2$

7) $144 \div 16 \times 4+5 \times 6 \div 3$

8) $91 \div (5+8)+6-(3 \times 4)$

9) $16 \times 8-12 \times 9+7 \times 2-24$

10) $1000-7 \times 12-11 \times 16-552 \div 6$

**1-17 Rounding off whole numbers to nearest tens, hundreds etc. :**

Consider the whole number 48. There are 4 tens and 8 ones in it. 40 is 8 away from 48 and 50 is just 2 away from 48. We say 48 is nearer 50 than 40.

Hence in round number 48 can be considered as 50.

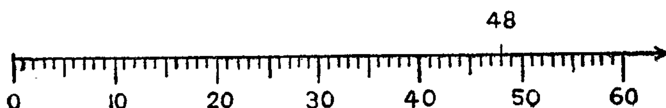



**Fig. 1-26**

Let us take 32. This is nearer 30 than 40. 32 can therefore be expressed as 30 correct to ten.

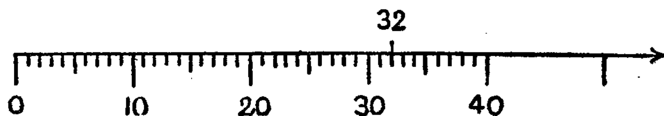



**Fig. 1-27**

**Note:** If the unit digit in a number is 5 or greater than 5 we round it off to the next ten. Thus we express the number correct to ten. If the unit digit is equal to or less than 4, we neglect it.

(e. g.) 69 is 70 correct to tens.

54 is 50 correct to tens.

Let us consider number 276. It has 2 hundreds, 7 tens and 6 ones. That is, 276 = 2 hundreds + 76. Note the position of the number in the number ray.

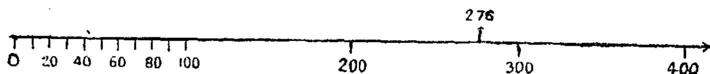



Fig. 1-28

This number is nearer 300 and farther from 200. Therefore this can be taken as 300 when given in hundreds. Similarly, 340 is shown on the number ray given below.

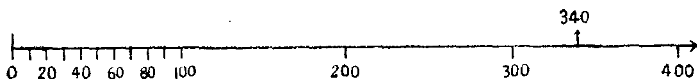



Fig. 1·29

The number 340 is nearer 300 and farther from 400. Therefore this number when given in hundreds can be expressed as 300.

**Note:** To tell a number correct to hundreds, we note the digit in the ten's place. If it is 5 or more, we add 1 to the digit in the hundred's place. If it is 4 or less, we neglect it.

$\simeq$ is the symbol used to express approximation.

(e.g.) $683 \simeq 700$ (Given in hundreds)
$835 \simeq 800$ (Given in hundreds)

**Exercise 1-12**

1. Show each of the following whole numbers on a number line and express each of them in tens.

   (a) 64 (b) 46 (c) 39 (d) 52 (e) 326 (f) 95 (g) 218 (h) 175

2. The population of a town is 81,71,962. Express it in hundreds.

3. A man has Rs. 24,500 in his account in a bank. Express it in tens.

4. Express the following numbers in tens and in hundreds.

| | Number | in tens | in hundreds. |
|---|---|---|---|
| i) | 547 | | |
| ii) | 1,364 | | |
| iii) | 84 | | |
| iv) | 5,055 | | |
| v) | 10,372 | | |

## Exercise 1-13

1. 23 persons have to travel from one place to another. A car can take only 4 at a time. In all how many trips are to be made?

2. The distance between two places is 41 m. Pillars are put up 1 m apart from one another. How many pillars are there?

3. 3 teachers and 4 students go to a studio. Each student wants to take a photograph of himself with each of the teachers separately. In all how many photographs have to be taken?

4. A student had Rs. 10 with him. His father gave him Rs. 24. He spent Rs. 6. He bought books for the balance at the rate of Rs. 7 per copy. Denote these sentences using the correct mathematical symbols.

5. a) Given 3 digits other than 0, how many numbers can be formed?

   b) If one of the digits given is zero, how many numbers can be formed?

6. How many millions make 10 crore?

7. What is the difference between the predecessor and the successor of a whole number?

8. Write in the standard form of numeration $10^7$.

## ANSWERS

**Exercise 1-1**

1. *(a)* Six hundred five *(b)* One thousand, eight hundred ninety two *(c)* Nine thousand, nine hundred ninety nine (d) Ninety thousand, six hundred eight (e) Three lakh, seventy thousand, two hundred sixteen (f) Twenty six lakh, seventy two thousand three hundred five *(g)* One crore, two lakh, thirty thousand, seventy four.

2. *(a)* Three hundred fifteen thousand, one hundred forty seven.
   *(b)* Two hundred eight thousand, two hundred and fourteen.
   (c) One million, three hundred ten thousand, three hundred ten.
   (d) Twenty four million, seventy thousand, eighty nine.

3. *(a)* 1,09,82,104 *(b)* 9,99,999 *(c)* 10,010 (d) 3,04,049
   *(e)* 40,70,908 *(f)* 98,76,543 (g) 10,08,012
   (h) 16,04,610

4. (a) 8 tens (b) 5 thousands (c) 1 hundred thousands
   (d) 7 ten thousands (e) 6 hundred thousands
   (f) 9 thousands

5. (a) 8 hundred→ 8 thousand
   2 ten→ 2 hundred
   (b) 60 thousand→ 6 hundred
   5 hundred→ 5 ten
   (c) (i) 9,99,999 (ii) 1
   (d) 90,000

6. (a) 10 times (b) third power ($10^3$) (c) Fourth power ($10^4$)
   (d) 180 times (e) 10 times (f) fifth power ($10^5$) (g) 1 time

7. (a) 20,000+4,000+100+80+5
   (b) 30,000+5,000+700+60+4
   (c) 40,000+1,000+40+6
   (d) 30,000+400+60+5
   (e) 50,000+400+20+8
   (f) 10,000+8,000+700+9

8. (a) $3 \times 10^4 + 6 \times 10^3 + 2 \times 10^2 + 4 \times 10^1 + 8$
   (b) $7 \times 10^4 + 1 \times 10^3 + 2 \times 10^2 + 8 \times 10^1 + 3$
   (c) $2 \times 10^4 + 4 \times 10^2 + 7 \times 10^1 + 1$
   (d) $3 \times 10^4 + 4 \times 10^3 + 6 \times 10 + 5$
   (e) $2 \times 10^4 + 8 \times 10^3 + 7 \times 10^2 + 2$
   (f) $4 \times 10^4 + 5 \times 10^3 + 3 \times 10^1 + 8$

9. (a) 6,349 (b) 25,276 (c) 30,303

10. (a) 5,63,724 (b) 38,765 (c) 6,07,039 (d) 87,05,023

## Exercise 1-2

1. (a) True (b) False (c) True (d) True (e) False (f) True

2. (a) to the left (b) right (c) left (d) right

3. (a) $6 < 8$ (b) $111 > 101$ (c) $200 > 199$ (d) $899 < 900$

4. (a) 15; 872; 6,042; 13,798; 24,001.
   (b) 5,678; 5,687; 5,768; 5,786; 5,876.
   (c) 7,777; 9,999; 10,000; 10,565; 12,181.

5. (a) 12,410; 7,089; 6,139; 762; 456.
   (b) 3,952; 3,592; 3,529; 3,295; 3,259.
   (c) 12,356; 11,247; 10,234; 9,898; 9,324.

6. (a) greatest: 64,320; least; 20,346
   (b) greatest: 87,521; least; 12,578
   (c) greatest: 75,320; least; 20,357
   (d) greatest: 98,760; least: 60,789

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 7. Predecessors : | 100 | 998 | 197 | 221 |
| Successors : | 102 | 1,000 | 199 | 223 |

## Exercise 1-3

1. (a) 3+4=7 (b) 4+3+6=13 (c) 5+5+0=10
(d) 2+3+4+5=14

3. (a) True. (b) True.

4. (a) 1,264. (b) 864. (c) 1,200.

## Exercise 1-4

1. 23,403 3. 26,852 5. 8,15,683 7. 17,850
2. 3,118 4. 2,02,207 6. 10,26,088 8. Rs. 334

9. The price of the T. V. is Rs. 3,308;
Total price: Rs. 4,154.

10. 6th std. 231; 7th std. 190; 8th std. 164;
Total: 585.

## Exercise 1-5

1. (a) 12—8=4; 12—4=8 (b) 100—36=64; 100—64=36
(c) 125—40=85; 125—85=40; (d) 120—70=50; 120—50=70

2. (a) 9—3=6 (b) 13—7=6. (c) 12—12=0.
4. 4,588 5. 7,303 6. 27,705 7. 7,17,795 8. 5,36,393
9. 8,76,544. 10. 116 persons less. 11. 55,953 12. Rs. 11,035
13. 55,662 more. 14. 1,150; 12,273; 16,448 15. 34,036.

## Exercise 1-6

1. 59 2. 2,146 3. 3,571 4. 2,534 5. 24,651; 15,349
6. 66,644 7. 4,3,2,0,0 8. Rs. 1,380 9. (a) 1 (b) 12
(c) 9 (d) 11. 10. Rs. 2,476 11. Rs. 6,854; Rs.35,600.
12. 21,048 females; 280 males more.

## Exercise 1-7

1. (a) $3\times3=9$ (b) $2\times5=10$ (c) $3\times6=18$ (d) $5\times5=25$
(e) $3\times7=21$ (f) $3\times10=30$.

2 (a) True (b) False (c) True (d) True (e) True
(f) True (g) False.

3. (a) $5\times8=40$ (b) $5\times0=0$ (c) $1\times5=5$ (d) $6\times1=6$
4. (a) 585 (b) 7,722 (c) 1,23,876
5. (a) 924 (b) 16,463 (c) 1,32,132
6. (a) 448 (b) 6,566 (c) 1.04,790
7 (a) 1,248 (b) 6,936 (c) 73,146
8. (a) 768 (b) 600 (c) 900

## Exercise 1-8

1. 44,688 2. 3,27,762 3. 19,58,187 4. 21,01,120
5. Rs. 1,375 6. 16,848 7. Rs. 3,088 8. Rs. 8,876
9. Rs. 15,32,745 10. 1,16,541 stones.

## Exercise 1-9

1. (a) $18\div6=3$ (b) $14\div2=7$

2. (a) $14\div3$; Quotient 4, remainder 2.
(b) $19\div4$; Quotient 4; remainder 3.

3. (a) $6\times3=18$ (b) $9\times6=54$ (c) $11\times9=99$ (d) $9\times9=81$
$3\times6=18$ $6\times9=54$ $9\times11=99$

4. (a) $35\div7=5$ (b) $91\div13=7$ (c) $108\div12=9$
$35\div5=7$ $91\div7=13$ $108\div9=12$
(d) $240\div16=15$
$240\div15=16$

5. Dividend: 75

6. Divisor: 11; dividend: 175; quotient: 15; remainder: 10

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 7. Quotient: | 212 | 54 | 19 | 205 |
| Remainder: | 24 | 31 | 523 | 1 |

### Exercise 1-10

1. 347 2. 5,042 3. 998 4. 4,007 5. Quotient 2902, Remainder 17 6. Quotient 2,661, Remainder 131

7 75,545 8. 249 packets 37 pencils left out. 9. Rs. 275 10. 223 should be added 11. 145 boxes. Remainder 2 kg 500 gms 12. 9 shirts, 65 cm long cloth left out.

### Exercise 1-11

(1) 24 (2) 44 (3) 94 (4) 61 (5) 13 (6) 1 (7) 46 (8) 1 (9) 10 (10) 648

### Exercise 1-12

1 (a) 6 tens (b) 5 tens (c) 4 tens (d) 5 tens (e) 33 tens (f) 10 tens (g) 22 tens (h) 18 tens

2. 81,720 hundreds 3. 2,450 tens 4. (i) 55 tens, 5 hundreds (ii) 136 tens, 14 hundreds (iii) 8 tens, 1 hundred (iv) 506 tens, 51 hundreds (v) 1,037 tens, 104 hundreds

### Exercise 1-13

1. 6 trips 2. 42 pillars 3. 12 photographs

4. $(10+24-6)\div 7$ 5. (a) 6 numbers (b) 4 numbers

6. 100 million 7. 2 8. 1,00,00,000

# 2. Fractional Numbers

**2-1 The need for fractional numbers and their forms:**

You have already studied about fractional numbers in the earlier classes.

I cut a bread into ten equal slices. Each slice is 'one tenth' of the whole and it is noted as $\frac{1}{10}$. If I take 3 slices, it will be $\frac{3}{10}$ of the whole bread. So we need fractional numbers to denote the parts of a single unit. $\frac{3}{10}$ is a fraction. It means 3 parts of 10.

$\frac{2}{3}$ is a fraction. It is a **proper fraction** as its value is less than one. 2 is called the numerator and 3, the denominator. In proper fractions the numerator will be smaller than the denominator.

$\frac{3}{2}$ is also a fraction. But it is an **improper fraction** as its numerator is larger than its denominator and its value is greater than one.

A mixed number consists of a whole number and a fraction written together. It only means that they are to be added to each other. Thus $1\frac{9}{10}$ means $1 + \frac{9}{10}$ and $2\frac{3}{5}$ means $2 + \frac{3}{5}$.

$\frac{2}{3}$ is read as two thirds; $\frac{3}{10}$ is read as three tenths;
$\frac{3}{2}$ is read as three halves; $\frac{3}{4}$ is read as three quarters.
$\frac{2}{3}$, $\frac{3}{10}$, $\frac{3}{2}$, $\frac{3}{4}$ are numerals for fractional numbers.

**Exercise 2-1**

1. In the following figures a part of each is shaded. Find out what part of the whole is shaded in each case.

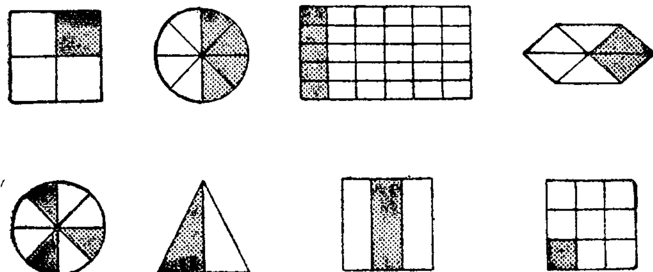


Fig 2-1

2. All the rational numbers are fractional numbers. Why?

3. Express the following divisions as fractional numbers.
   (a) $29 \div 5$ (b) $5 \div 3$ (c) $7 \div 4$ (d) $11 \div 6$

4. Find out the value of x.
   (a) $2x = 3$ (b) $3x = 4$ (c) $5x = 8$ (d) $9x = 10$

5. Can zero be considered as a fractional number? Why?

## 2-2 Form of Fractional Numbers :

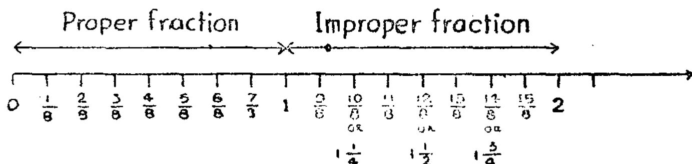



Fig. 2-2

Observe the fractional numbers to the left of 1 on the number ray. For example, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$ etc. You can see that in each case the numerator is less than the denominator and hence each one is less than one.

In fractional numbers like $\frac{9}{8}$, $\frac{11}{8}$, $\frac{12}{8}$, $\frac{14}{8}$, etc., you can see that the numerator is greater than the denominator in each case. These fractional numbers lie to the right of 1 on the number ray. Naturally each one of them is greater than one.

Every improper fractional number can be written as a mixed fractional number.

**Example :** $\frac{15}{8} = 1\frac{7}{8}$ (This can be seen on the number ray.)

Every mixed fractional number can be written as an improper fractional number.

**Example :** $1\frac{5}{8} = \frac{13}{8}$ (Refer the number ray we have already discussed.)

Consider the following figure.

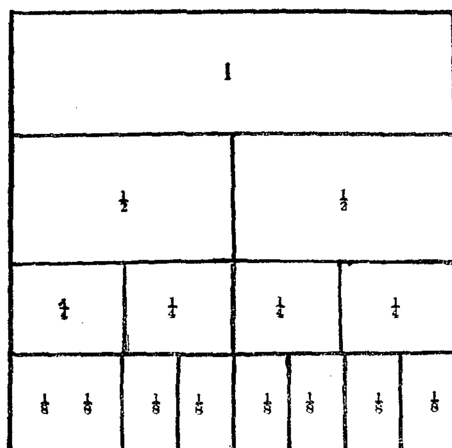



Fig. 2-3

From this it is clear that 1 = 2 halves = 4 Quarters = 8 one eighths.

Study the following number ray.

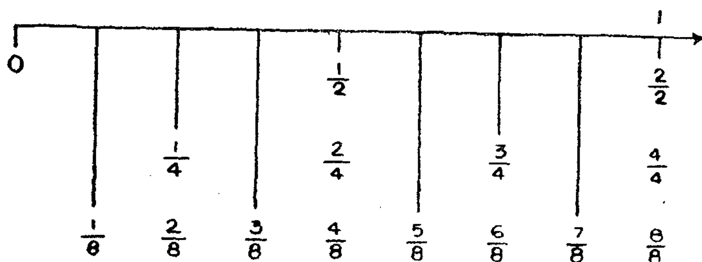



Fig. 2 · 4

From this we learn that $\frac{1}{2}$, $\frac{2}{4}$, $\frac{4}{8}$, are different names of a fractional number. In this case it is $\frac{1}{2}$

On the number ray these fractional numbers denote the same point These fractional numbers are called equivalent fractional numbers.

The fractional numbers representing the same fractional number are called **equivalent fractional numbers.**

$\frac{1}{4}$, $\frac{2}{8}$ are equivalent fractional numbers.

$\frac{1}{2}$, $\frac{2}{4}$, $\frac{4}{8}$ are equivalent fractional numbers.

$\frac{3}{4}$, $\frac{6}{8}$ are equivalent fractional numbers.

$$\frac{1}{4} = \frac{2 \times 1}{2 \times 4} = \frac{2}{8}$$

$$\frac{1}{2} = \frac{2 \times 1}{2 \times 2} = \frac{2}{4}; \quad \frac{1}{2} = \frac{4 \times 1}{4 \times 2} = \frac{4}{8}$$

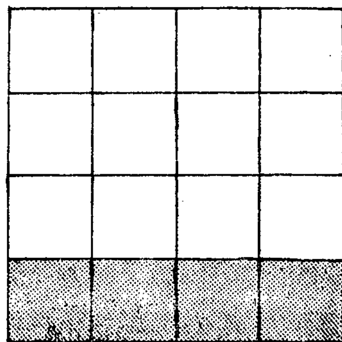
$$\frac{3}{4} = \frac{2 \times 3}{2 \times 4} = \frac{6}{8}$$

From the above patterns, we understand how to find equivalent fractional numbers.

If we multiply both the numerator and the denominator of a fractional number by a non-zero number we get an equivalent fractional number.

Further, from the above number ray, we see that if the numerator and the denominator of a fractional number are non-zero equal numbers, it represents 1

Study the following diagram. It illustrates $\frac{1}{4} = \frac{4}{16}$



$$\frac{1}{4} = \frac{4}{16}$$

Fig 2-5

**Practical :**

In a graph sheet draw rectangular diagrams to illustrate

$\frac{1}{3} = \frac{5}{15}$; $\frac{3}{8} = \frac{6}{16}$.

## 2-3. Comparison of fractional numbers :

Consider two fractional numbers on the number ray.

**If two fractional numbers have the same denominator, the fractional number having the greater numerator is greater than the other one.**

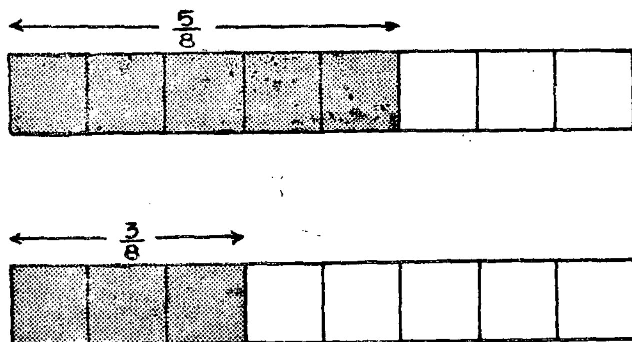



Fig. 2-6

$\frac{5}{8} > \frac{3}{8}$.

Consider any two fractional numbers $\frac{3}{8}$ and $\frac{3}{4}$. We know $\frac{3}{4} > \frac{3}{8}$.

Thus **if two fractional numbers have the same numerator but different denominators, the one with the smaller denominator is greater than the one with the bigger denominator.**

Consider the two fractional numbers $\frac{2}{3}$ and $\frac{4}{5}$. The least common multiple of the denominators is 15

$$\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15};$$

$$\frac{4}{5} = \frac{4 \times 3}{5 \times 3} = \frac{12}{15}.$$

$\frac{10}{15}$ and $\frac{12}{15}$ are the names for $\frac{2}{3}$ and $\frac{4}{5}$ respectively.

$\frac{12}{15}$ is greater than $\frac{10}{15}$.

$\therefore$ $\frac{4}{5}$ is the greater one.

Write the following fractional numbers in the ascending order. $\frac{2}{3}$, $\frac{3}{5}$, $\frac{1}{2}$, $\frac{3}{4}$

The l. c. m. of the denominators 3, 5, 2 and 4 is 60.

Let us rename the fractional numbers so that they have the same denominator 60.

$\frac{2}{3} = \frac{40}{60}$; $\frac{3}{5} = \frac{36}{60}$; $\frac{1}{2} = \frac{30}{60}$; $\frac{3}{4} = \frac{45}{60}$.

Now the fractions can be arranged in the ascending order as shown below. The denominators are the same $\frac{30}{60}$, $\frac{36}{60}$, $\frac{40}{60}$, $\frac{45}{60}$. The fractions may, therefore be arranged in ascending order of the numerators.

$\therefore$ $\frac{1}{2}$, $\frac{3}{5}$, $\frac{2}{3}$, $\frac{3}{4}$ (In the ascending order).

On the other hand the one shown below is in the descending order.

$\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{1}{2}$.

**2-4 Reducing a fractional number to its simplest form :**

Consider the fractional number $\frac{72}{96}$. The g. c. d. of 72 and 96 is 24.

$$\therefore \frac{72}{96} = \frac{3 \times 24}{4 \times 24} \text{ or } \frac{3}{4}.$$

$\therefore$ $\frac{3}{4}$ is the simplest form of $\frac{72}{96}$.

**Exercise 2-2**

1. State whether the following are proper, improper or mixed fractional numbers.

   (i) $\frac{2}{3}$ (ii) $\frac{5}{4}$ (iii) $\frac{7}{8}$ (iv) $\frac{6}{5}$ (v) $1\frac{2}{3}$ (vi) $2\frac{1}{4}$
   (vii) $\frac{5}{8}$ (viii) $\frac{7}{3}$.

2. State three equivalent fractional numbers for each of the following.

   (i) $\frac{2}{3}$ (ii) $\frac{3}{4}$ (iii) $\frac{5}{8}$ (iv) $\frac{4}{3}$.

3. State whether the following fractional numbers are in the simplest forms.

   If not, reduce them to their simplest forms.
   (a) $\frac{1}{3}$ (b) $\frac{2}{5}$ (c) $\frac{4}{6}$ (d) $\frac{7}{8}$ (e) $\frac{3}{9}$ (f) $\frac{5}{10}$.

4. Complete the following to make them true.

   (a) $\frac{7}{10} = \frac{\ }{20}$ (b) $\frac{13}{16} = \frac{39}{\ }$ (c) $\frac{\ }{4} = \frac{15}{20}$ (d) $\frac{6}{\ } = \frac{18}{33}$.

5. Draw rectangular diagrams to illustrate $\frac{1}{5} = \frac{2}{10} = \frac{4}{20}$.

6. What part of the second is the first in each of the following?
   (a) 25 p. 1 rupee (b) 20 cms, 1 m (c) 700 ml, 1 l
   (d) 400 m, 1 k.m. (e) 5 quintal, 1 tonne (f) 600 gms, 1 kg
   (g) 2 hours 24 minutes, 1 day. (h) 4 dozen, 1 gross.

7. Write answers in fractional numbers :
   (a) The cost of 4 sweets is 15 paise. Find the cost of one.
   (b) 3 bananas cost 20 paise The cost of one banana is . . . .
   (c) 2 note books cost 85 paise. The cost of one note book is . . . .

8. Express the following in their simplest forms.

   (a) $\frac{112}{144}$ (b) $\frac{77}{121}$ (c) $\frac{39}{52}$ (d) $\frac{63}{84}$.

9. Write the equivalent fractional numbers of the following, with 24 as their denominator.

   (a) $\frac{3}{8}$ (b) $\frac{5}{6}$.

10. Write the equivalent fractional numbers of the following, with 18 as their numerator.

    (a) $\frac{6}{7}$ (b) $\frac{9}{13}$.

11. Write the following as mixed numbers.

(a) $\frac{21}{5}$ (b) $\frac{8}{3}$ (c) $\frac{85}{16}$ (d) $\frac{70}{9}$ (e) $\frac{65}{11}$.

12. Write the following as improper fractional numbers.

(a) $2\frac{1}{3}$ (b) $3\frac{4}{5}$ (c) $4\frac{3}{10}$ (d) $3\frac{1}{7}$ (e) $4\frac{8}{11}$.

## Exercise 2-3

1. Which is the greater one in each of the following pairs

(a) $\frac{7}{8}$, $\frac{5}{8}$, (b) $\frac{7}{11}$, $\frac{6}{11}$ (c) $\frac{3}{5}$, $\frac{4}{5}$ (d) $\frac{4}{5}$, $\frac{4}{7}$ (e) $\frac{18}{13}$, $\frac{19}{13}$

(f) $\frac{8}{9}$, $\frac{8}{11}$ (g) $\frac{3}{4}$, $\frac{4}{5}$ (h) $\frac{7}{9}$, $\frac{5}{8}$ (i) $\frac{1}{10}$, $\frac{19}{15}$.

2. Which is the smaller one in each of the following pairs.

(a) $\frac{4}{9}$, $\frac{5}{9}$ (b) $\frac{6}{7}$, $\frac{5}{7}$ (c) $\frac{10}{11}$, $\frac{9}{11}$ (d) $\frac{8}{7}$, $\frac{8}{9}$ (e) $\frac{4}{11}$, $\frac{4}{13}$

(f) $\frac{12}{13}$, $\frac{12}{17}$ (g) $\frac{2}{3}$, $\frac{3}{4}$, (h) $\frac{5}{6}$, $\frac{7}{8}$ (i) $\frac{9}{10}$, $\frac{11}{12}$

3. Which is cheaper in each case?

(a) 12 roses for 50 paise or 8 roses for 30 paise.

(b) 7 fruits for 75 paise or 5 fruits for 65 paise.

(c) 11 dolls for Rs. 24 or 7 dolls for Rs. 18.

4. Find the greatest and the smallest fractional numbers.

(a) $\frac{1}{2}$, $\frac{11}{20}$, $\frac{3}{5}$, $\frac{5}{8}$ (b) $\frac{2}{3}$, $\frac{5}{6}$, $\frac{4}{9}$, $\frac{11}{18}$.

5. Write in the ascending order of the numbers.

$\frac{2}{3}$, $\frac{2}{5}$, $\frac{4}{5}$, $\frac{3}{4}$, $\frac{13}{20}$.

6. Write in the descending order of the numbers.

$\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, $\frac{9}{16}$, $\frac{17}{32}$.

7. A diluted acid contains three fourths of water. Another contains five sevenths of water. Which is stronger?

8. A student scored 12 out of 20 in the test. In the next test he scored 32 out of 50. In which test did he score more?

## 2-5 Addition in fractional numbers :

### 2-5. 1 Addition of like fractional numbers :

Study the following number ray.




Fig. 2 - 7

Every point on the number ray represents a jump of $\frac{1}{8}$ from the previous number. $\frac{4}{8}$ represents 4 jumps of $\frac{1}{8}$.
We see $\frac{3}{8} + \frac{4}{8} = 7$ jumps = of $\frac{1}{8} = \frac{7}{8}$.

**If the two fractional numbers are like fractional numbers, then their sum is a fractional number whose numerator is the sum of their numerators and denominator is their denominator.**

(e. g.) $\frac{5}{9} + \frac{3}{9} = \frac{5 + 3}{9} = \frac{8}{9}$

**Note :** To find the sum of like fractional numbers, we add the numerators only but not the denominators The denominator remains the same.

Observe the following number ray.

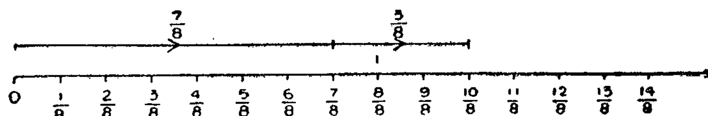



Fig. 2 - 8

$\frac{7}{8} + \frac{3}{8}$ is shown here.

$\frac{7}{8} + \frac{3}{8} + \frac{7 + 3}{8} = \frac{10}{8} = \frac{5 \times 2}{4 \times 2} = \frac{5}{4} = 1\frac{1}{4}$.

**If the sum of two fractional numbers is an improper fraction, we have to convert into a mixed fractional number. The fractional number part is expressed in its simplest form.**

**2-5. 2. Addition of unlike fractional numbers :**

To add any two unlike fractional numbers, we have to convert them into like fractional numbers, that is, make their denominators the same. We have to express them as equivalent fractional numbers with the same denominators and then add.

(e. g.) Add : $\frac{3}{8} + \frac{5}{12}$

The l. c. m. of 8 and 12. is 24

$\frac{3}{8} = \frac{9}{24}$; $\frac{5}{12} = \frac{10}{24}$

$\therefore \frac{3}{8} + \frac{5}{12} = \frac{9}{24} + \frac{10}{24} = \frac{19}{24}$

**2-5. 3. Addition of mixed fractional numbers :**

Add : $2\frac{2}{3} + 5\frac{1}{2}$

**Method I :**

To add two mixed fractional numbers, first add the whole number parts then add the fractional number parts and then express as a mixed fractional number.

$2\frac{2}{3} + 5\frac{1}{2} = 2 + 5 + \frac{2}{3} + \frac{1}{2}$

$= 7 + \frac{2}{3} + \frac{1}{2}$

$= 7 + \frac{4}{6} + \frac{3}{6}$ (l. c. m of 3 and 2 is 6)

$= 7 + \frac{7}{6}$

$= 7 + 1 + \frac{1}{6} = 8\frac{1}{6}$

**Method II :**

First express the given mixed fractional numerators as improper fractional numbers and then add as in **2-5.**

$2\frac{2}{3} + 5\frac{1}{2} = \frac{8}{3} + \frac{11}{2}$

$= \frac{16}{6} + \frac{33}{6}$ (l.c.m of 3 and 2 is 6)

$= \frac{49}{6} + 8\frac{1}{6}$

**Note :** The fractional numbers can be added in any order.

(e. g.) $\frac{2}{3}+\frac{3}{5}+\frac{4}{7}=\frac{3}{5}+\frac{2}{3}+\frac{4}{7}=\frac{4}{7}+\frac{2}{3}+\frac{3}{5}$.

### Exercise 2-4

1. State the addition facts illustrated in the following number rays

a)

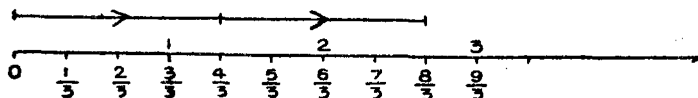



Fig. 2-9

b)

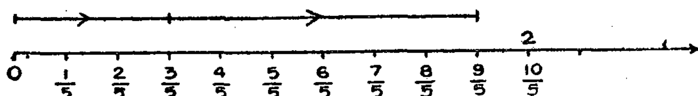
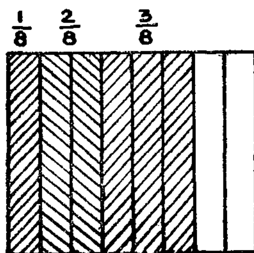



Fig. 2-10

State the addition facts illustrated in the following diagrams.



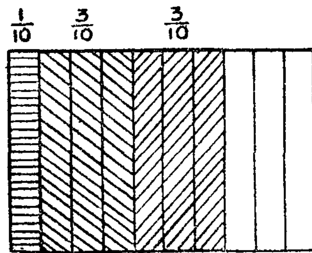




Fig. 2-11

3. **Simplify :**

a) $\frac{1}{12} + \frac{5}{12} + \frac{7}{12} + \frac{11}{12}$

b) $\frac{1}{8} + \frac{7}{8} + \frac{3}{8} + \frac{5}{8}$

c) $\frac{7}{18} + \frac{11}{18} + \frac{13}{18} + \frac{17}{18}$

d) $\frac{1}{11} + \frac{4}{11} + \frac{6}{11} + \frac{8}{11}$

4. **Simplify :**

a) $\frac{1}{2} + \frac{1}{3}$  b) $\frac{3}{4} + \frac{5}{6}$  c) $\frac{1}{2} + \frac{3}{4}$

d) $\frac{8}{9} + \frac{5}{12}$  e) $\frac{7}{8} + \frac{3}{16}$  f) $\frac{4}{10} + \frac{7}{15}$

5. **Simplify :**

a) $\frac{1}{3} + \frac{1}{6} + \frac{1}{8}$  b) $\frac{1}{5} + \frac{3}{10} + \frac{7}{15}$

c) $\frac{3}{6} + \frac{5}{9} + \frac{11}{18}$  d) $\frac{4}{9} + \frac{1}{6} + \frac{2}{3}$

6. **Simplify :**

a) $1\frac{1}{2} + 2\frac{1}{4}$  b) $2\frac{1}{5} + 3\frac{7}{10}$

c) $6\frac{3}{8} + 2\frac{1}{4}$  d) $4\frac{1}{10} + 2\frac{37}{100}$.

7. **Simplify :**

a) $2\frac{2}{3} + 4\frac{1}{9} + 3\frac{5}{6}$  b) $3\frac{3}{8} + 2\frac{1}{2} + 1\frac{7}{10}$

c) $2\frac{3}{10} + 6\frac{9}{20} + 3\frac{17}{30}$  d) $1\frac{1}{7} + 3\frac{5}{14} + 4\frac{19}{21}$

8. A person spends $\frac{1}{5}$ of his salary on rent, $\frac{1}{2}$ on food, $\frac{1}{10}$ on educating his children and $\frac{3}{20}$ on other expenses. Express his total expenditure as a part of his salary.

9. A person gave away $\frac{2}{5}$ of his property to his son, $\frac{3}{10}$ to his wife $\frac{1}{20}$ for charity and $\frac{1}{10}$ to his daughter. Find the portion of his property disposed of by him.

**2-6 Subtraction in Fractional numbers :**

**2-6 1. Subtraction of two like fractional numbers :**

Observe the following number ray. Each point represents a jump of 1/16 on the number ray. The 11th point represents 11/16.

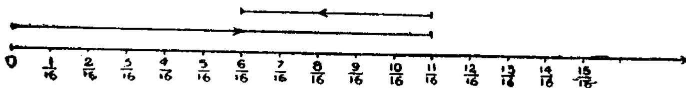



Fig. 2 - 12

$\frac{11}{16} - \frac{5}{16}$ means a jump of 5 points in the opposite direction from $\frac{11}{16}$ to reach $\frac{6}{16}$. (i. e.) $\frac{11}{16} - \frac{5}{16} = \frac{6}{16}$.

**To subtract a fractional number from another like fractional number keep the difference between the numerators as the numerator and write the denominator of those fractional numbers as the denominator.**

(e. g.) $\frac{7}{8} - \frac{3}{8} = \frac{7-3}{8} = \frac{4}{8} = \frac{1 \times 4}{2 \times 4} = \frac{1}{2}$

(The answer should be expressed in its simplest form).

**2-6 2. Subtraction of unlike fractional numbers :**

First express the given fractional numbers as like fractional numbers and do as explained in 2-6-1.

(e. g) Simplify : $\frac{11}{16} - \frac{5}{12}$ (l.c.m. of 16 and 12 is 48).

$\frac{11}{16} = \frac{33}{48}$, $\frac{5}{12} = \frac{20}{48}$.

Hence $\frac{11}{16} - \frac{5}{12} = \frac{33}{48} - \frac{20}{48} = \frac{33-20}{48} = \frac{13}{48}$

**2-6 3. Subtraction in mixed fractional numbers :**

Study the following examples.

(e.g.) (i) $5\frac{1}{2} - 2\frac{1}{4}$ $[\frac{1}{2} > \frac{1}{4}]$

$= 5 - 2 + \frac{1}{2} - \frac{1}{4}$ (Separate the whole numbers and fractional numbers).

$= 3 + \frac{2}{4} - \frac{1}{4}$

$= 3 + \frac{1}{4} = 3\frac{1}{4}$

(ii) $= 5\frac{1}{3} - 2\frac{11}{16}$ $(\frac{1}{3} < \frac{11}{16})$

$= 5 - 2 + \frac{1}{3} - \frac{11}{16}$

$= 3 + \frac{16}{48} - \frac{33}{48}$

$= 2 + 1 + \frac{16}{48} - \frac{33}{48}$ (Since we cannot subtract 33 from 16 we take 1 from 3.)

$= 2 + \frac{48}{48} + \frac{16}{48} - \frac{33}{48}$ (1 is expressed as $\frac{48}{48}$),

$= 2 + \frac{64}{48} - \frac{33}{48}$

$= 2 + \frac{64 - 33}{48}$

$2 + \frac{31}{48} = 2\frac{31}{48}$

We can express the mixed fractional numbers as improper fractional numbers and then subtract.

$5\frac{1}{3} = \frac{16}{3}$; $2\frac{11}{16} = \frac{43}{16}$

$5\frac{1}{3} - 2\frac{11}{16} = \frac{16}{3} - \frac{43}{16}$

$\frac{256}{48} - \frac{129}{48}$

$= \frac{256 - 129}{48} = \frac{127}{48} = 2\frac{31}{48}$

## Exercise 2-5

State the subtraction facts illustrated in the following number rays.

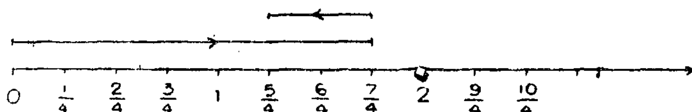



Fig. 2-13

b)

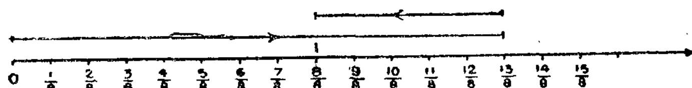



**Fig.** 2.14

2. Find the value of.
   (a) $\frac{3}{8} - \frac{1}{8}$ (b) $\frac{11}{16} - \frac{5}{16}$ (c) $\frac{9}{11} - \frac{3}{11}$

3. Find the value of:
   (a) $\frac{2}{3} - \frac{5}{9}$ (b) $\frac{7}{12} - \frac{1}{4}$ (c) $\frac{3}{4} - \frac{13}{20}$

4. Find the value of·
   (a) $3\frac{2}{8} - 2\frac{3}{8}$ (b) $5\frac{4}{9} - 2\frac{3}{7}$ (c) $10 - 6\frac{1}{4}$

5 The sum of two fractional numbers is $8\frac{3}{5}$. One of them is 4[illegible] Find the other.

6. What added to $6\frac{7}{10}$ will make it 16 ?

7. From a ribbon 10 m. long $4\frac{3}{4}$ m were cut off. How many metres were left?

8. Fill in the blanks.
   (a) $5\frac{1}{2} + \ldots = 6\frac{3}{4}$ (b) $4\frac{3}{10} + \ldots = 7\frac{1}{5}$.
   (c) $\ldots + 6\frac{5}{12} = 9\frac{3}{4}$ (d) $\ldots + 3\frac{1}{3} = 7$.

**2-7 Addition and Subtraction :**

If we have to do both the operations of addition and subtraction,

(i) Find the sum of all the fractional numbers to be added.

(ii) Find the sum of all the fractional numbers to be subtracted.

(iii) Subtract the second sum from the first sum.

(e. g.) **Simplify :** $5\frac{1}{2} + 2\frac{1}{4} - 7\frac{3}{4} + 8\frac{1}{8} - 4\frac{1}{2}$
Adding fractions : $5\frac{1}{2}$, $2\frac{1}{4}$, $8\frac{1}{8}$
Subtracting fractions : $7\frac{3}{4}$, $4\frac{1}{2}$

Sum of adding fractions : $5\frac{1}{2} + 2\frac{1}{4} + 8\frac{1}{8}$

$= 5 + 2 + 8 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$

$= 15 + \frac{4 + 2 + 1}{8}$

$= 15\frac{7}{8}$ (i)

Sum of subtracting fractions : $= 7\frac{3}{4} + 4\frac{1}{2}$

$= 7 + 4 + \frac{3}{4} + \frac{1}{2}$

$= 11 + \frac{3 + 2}{4} + 11\frac{5}{4}$ (ii)

$= 11 + 1\frac{1}{4} = 12\frac{1}{4}$

$5\frac{1}{2} + 2\frac{1}{4} - 7\frac{3}{4} + 8\frac{1}{8} - 4\frac{1}{2}$ = sum (i) — sum (ii)

$= 15\frac{7}{8} - 12\frac{1}{4}$

$= 15 - 12 + \frac{7}{8} - \frac{1}{4}$

$= 15 - 12 + \frac{7}{8} - \frac{2}{8}$

$= 3 + \frac{7 - 2}{8} = 3\frac{5}{8}$

## Exercise 2-6

1. **Simplify :**

   a) $5\frac{1}{2} + 4\frac{3}{4} - 7\frac{1}{4}$
   b) $6\frac{2}{5} + 3\frac{1}{10} - 2\frac{7}{15}$
   c) $4\frac{5}{6} - 7\frac{1}{3} + 8\frac{1}{4} - 1\frac{9}{16}$.
   d) $25\frac{1}{2} - 6\frac{1}{4} - 3\frac{1}{8} - 4\frac{3}{5}$
   e) $4\frac{3}{4} - 8\frac{1}{6} + 15\frac{7}{12} - 10\frac{13}{16}$
   f) $100 - 21\frac{5}{8} - 13\frac{1}{8} - 16\frac{3}{4}$

2. Find the sum of $2\frac{1}{2}$ and $3\frac{4}{15}$. What added to this sum will make it 10 ?

3. Murugan bought $15\frac{1}{2}$ m of cloth. In that he kept $5\frac{4}{5}$ m for himself and gave $7\frac{7}{10}$ m. to his brother. Find the length of cloth remaining.

4. A person travels $\frac{1}{2}$ the distance by train, $\frac{2}{5}$ by motor and the rest on foot. What part of the total distance was covered on foot?

5. A person sold away $\frac{5}{8}$ of the fruits he bought. $\frac{1}{10}$ of the whole perished. What part is left with him?

6. The sum of 3 numbers is 25. Two of them are $8\frac{7}{10}$ and $6\frac{8}{15}$. Find the third.

7. Kandan, Abdul and George joined together to do a work. Each of them completed $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{3}{10}$ of the work respectively. The rest was done by Mani. What part of the work was done by Mani?

## 2-8 Multiplication in fractional numbers:

### 2-8 1. Multiplication of a fractional number by a whole number:

You have learnt that multiplication is repeated addition and that multiplication can be explained as jumps in a number ray. In the number ray given below, each point represents $\frac{1}{8}$.

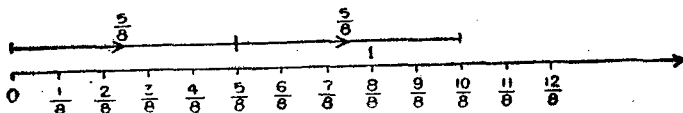



Fig. 2-15

$\frac{5}{8}$ is the fifth point on the number ray.

$\frac{5}{8} + \frac{5}{8} = 2 \times \frac{5}{8} = \frac{10}{8}$

Similarly,

$\frac{5}{8} + \frac{5}{8} + \frac{5}{8} = 3 \times \frac{5}{8} = \frac{15}{8}$

**Hence, to multiply a fractional number by a whole number, multiply its numerator by that whole number.**

(e.g.) The price of a doll is Rs. $2\frac{3}{4}$. Find the price of 10 dolls.

The price of 10 dolls = Rs. $2\frac{3}{4} \times 10$

= Rs. $\frac{11}{4} \times 10$ = Rs. $\frac{110}{4}$

= Rs. $27\frac{2}{4}$ = Rs. $27\frac{1}{2}$

**Note :** 1) The mixed number is expressed as an improper fractional number. The answer is given in the lowest form of the fraction.

2) If a fractional number is multiplied by the denominator, we get a whole number.

(e g.) $\frac{3}{8} \times 8 = 3$; $\frac{7}{15} \times 15 = 7$

3) If a fractional number is multiplied by 1, we get the same fractional number:

$\frac{3}{8} \times 1 = \frac{3}{8}$.

## Exercise 2-7

Find the value of the following :

1. a) $\frac{3}{5} \times 4$ b) $\frac{2}{7} \times 8$ c) $\frac{7}{10} \times 9$ d) $\frac{6}{11} \times 7$
2. a) $\frac{5}{8} \times 12$ b) $\frac{3}{4} \times 6$ c) $\frac{5}{9} \times 15$ d) $\frac{11}{14} \times 21$
3. a) $3\frac{1}{4} \times 3$ b) $4\frac{1}{6} \times 4$ c) $6\frac{3}{8} \times 2$ d) $2\frac{3}{16} \times 5$
4. a) $3\frac{1}{2} \times 7$ b) $2\frac{5}{8} \times 8$ c) $9\frac{5}{12} \times 9$ d) $9\frac{3}{11} \times 8$
5. a) $\frac{5}{12} \times 12$ b) $\frac{7}{8} \times 8$ c) $3\frac{2}{3} \times 3$ d) $5\frac{1}{6} \times 6$

6. The price of a note-book is Rs. $\frac{4}{5}$. Find the price of 12 note books.

7. 16 pages of a book form a section of a book. A book contains $8\frac{1}{4}$ sections. Find the number of pages in the book.

8. The monthly salary of a person is Rs. 400. He spends $\frac{1}{8}$ on transport and $\frac{1}{2}$ on food. How much money does he spend on each ?

9. There are 24 lead balls each weighing $1\frac{1}{10}$ kg. Find the total weight.

10. I have Rs. 42. My brother has $3\frac{1}{2}$ times that amount. Find the amount my brother has.

**2-8 2. Multiplication of a fractional number by another fractional number :**

To find $\frac{4}{5}$ parts of 3, we multiply 3 by 4 and divide the the product by 5. Similarly to find $\frac{2}{5}$ parts of $\frac{3}{4}$ we have to multiply $\frac{3}{4}$ by 2 and divide the product by 5.

That is, $\frac{3}{4} \times 2 \div 5$

$\frac{3}{4} \times 2 = \frac{6}{4}$; $\frac{6}{4} \div 5 = \frac{6}{20}$

$$\frac{3}{4} \times \frac{2}{5} = \frac{3 \times 2}{4 \times 5} = \frac{6}{20}$$

The grid diagram given below explains the same.

A rectangle is divided into 5 equal parts lengthwise. Two parts of the same are taken. It is equal to $\frac{2}{5}$ of the rectangle.

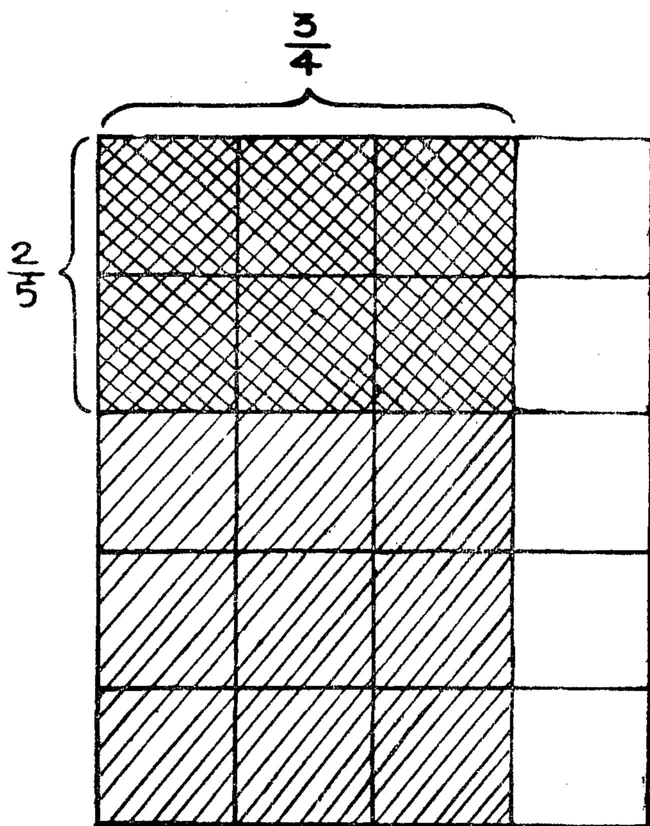



Fig. 2-16

The same rectangle is divided into 4 equal parts breadth wise. Three fourth of the rectangle is represented by three parts. The common area between the two represents $\frac{2}{5} \times \frac{3}{4}$. We find the rectangle is divided into 20 equal parts and the common area is denoted by 6 parts and is therefore equal to $\frac{6}{20}$ of the rectangle.

This means $\frac{2}{5} \times \frac{3}{4} = \frac{6}{20}$

**To find the product of the two fractional numbers; The denominator of the product is the product of the denominators. The numerator of the product is the product of the numerators.**

Study the following example :

$$\frac{4}{9} \times \frac{6}{10} = \frac{4 \times 6}{9 \times 10} = \frac{24}{90} = \frac{4 \times 6}{15 \times 6} = \frac{4}{15}$$

**Note :** To find the product of mixed fractional numbers, express the mixed fractional numbers as improper fractional numbers before multiplying them.

### Exercise 2-8

Find the value of the following :

1. (a) $\frac{3}{5} \times \frac{4}{7}$ (b) $\frac{3}{8} \times \frac{5}{9}$ (c) $\frac{6}{7} \times \frac{11}{13}$ (d) $\frac{2}{3} \times \frac{7}{11}$
2. (a) $\frac{7}{9} \times \frac{3}{14}$ (b) $\frac{8}{11} \times \frac{33}{64}$ (c) $\frac{5}{8} \times \frac{4}{15}$ (d) $\frac{7}{10} \times \frac{5}{21}$
3. (a) $\frac{3}{4} \times 1\frac{1}{2}$ (b) $\frac{5}{8} \times 1\frac{1}{5}$ (c) $\frac{7}{9} \times 3\frac{3}{5}$ (d) $\frac{6}{13} \times 1\frac{5}{8}$
4. (a) $2\frac{1}{4} \times 3\frac{1}{2}$ (b) $3\frac{3}{4} \times 4\frac{1}{4}$ (c) $7\frac{1}{2} \times 2\frac{8}{15}$ (d) $6\frac{2}{3} \times 3\frac{1}{4}$
5. (a) $\frac{2}{3} \times \frac{3}{4} \times \frac{1}{2}$ (b) $\frac{7}{8} \times \frac{4}{7} \times \frac{3}{5}$ (c) $\frac{2}{3} \times \frac{3}{5} \times \frac{5}{8}$ (d) $\frac{2}{3} \times \frac{3}{5} \times \frac{5}{9}$
6. The cost of a kg of salt is Rs. $\frac{2}{5}$. Find the cost of $7\frac{1}{2}$ kg of salt.
7. Find the price of $2\frac{2}{5}$ m of cloth at Rs. $7\frac{3}{4}$ per metre.
8. By how much is 50 greater than $7\frac{1}{4} \times 3\frac{3}{4}$ ?
9. What should be added on to $12\frac{1}{2} \times 4\frac{1}{2}$ to make it 100 ?

### 2-9. Reciprocals :

If the product of two fractional numbers is equal to 1, each fractional number is called the reciprocal of the other

(e. g.) $\frac{3}{5} \times \frac{5}{3} = 1$

$\frac{3}{5}$ is the reciprocal of $\frac{5}{3}$.

$\frac{5}{3}$ is the reciprocal of $\frac{3}{5}$.

$\frac{1}{4} \times 4 = 1$ $\therefore$ The reciprocal of $\frac{1}{4}$ is 4.

The reciprocal of 4 is $\frac{1}{4}$.

**Note** : 1) '0' has no reciprocal

2) The reciprocal of 1 is 1 itself.

### Exercise 2-9

Complete the following :

1. The reciprocal of $\frac{7}{8}$ is ——
2. $\frac{4}{9}$ should be multiplied by —— to get 1.
3. The product of a fractional number and its reciprocal is ——
4. 4 should be multiplied by —— to get 6.
5. 8 should be multiplied by —— to get 5.
6. The reciprocals of fractional numbers lying between $\frac{4}{3}$ and 3, lie between —— and ——.
7. A number and its reciprocal are the same. Find the number.
8. Find the reciprocals of :

a) $\frac{2}{5}$ b) $\frac{3}{5}$ c) $\frac{1}{4}$ d) $\frac{1}{8}$ e) $\frac{1}{10}$ f) $2\frac{1}{2}$ g) $3\frac{1}{3}$ h) 2

i) 7 j) 1.

9. Complete the following :

(a) $\frac{6}{11}$ × .. = 1 (b) 4 × .. = 1

c) $\frac{7}{10}$ × .. = 1 d) .. × 3 = 1.

**2-10. Division in fractiodal numbers :**

(e. g.) Divide $\frac{3}{10}$ by 4.

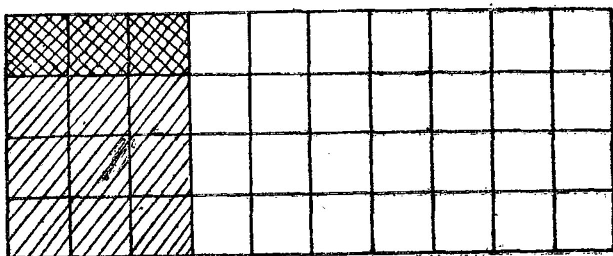


Fig. 2-17

Draw a rectangle. Divide it into 10 equal parts by drawing vertical lines. Mark $\frac{3}{10}$ of the rectangle. Divide the rectangle in 4 equal parts by drawing horizontal lines. Find how many squares are there in the common area. What is the total number of squares ? You find that the rectangle is divided into 40 equal parts and there are 3 squares in the common area. So we find $\frac{3}{10} \div 4 = \frac{3}{40}$.

It is the same as $\frac{3}{10} \times \frac{1}{4} = \frac{3}{40}$

Let us consider another example.

(e. g.) How many packets can be made out of 4 kg 600 gm of grain, if each packet contains 200 gm.

4 kg 600 gm = 4600 gm

Number of packets = $\frac{4600}{200}$ = 23.

This can be done using another method.

$$600 \text{ gm} = \frac{600}{1000} = \frac{3 \times 200}{5 \times 200} = \frac{3}{5} \text{ kg.}$$

$$200 \text{ gm} = \frac{200}{1000} = \frac{1 \times 200}{5 \times 200} = \frac{1}{5} \text{ kg}$$

$$\therefore \text{Number of packets} = 4\tfrac{3}{5} \div \tfrac{1}{5}$$
$$= \frac{23}{5} \div \frac{1}{5}$$
$$= \frac{23}{5} \times \frac{5}{1} = 23$$

From the above, we discover the following :

**Dividing one fractional number by another fractional number is the same as multiplying the dividend by the reciprocal of the divisor.**

(e. g.) $\frac{3}{8} \div \frac{2}{5} = \frac{3}{8} \times \frac{5}{2} = \frac{15}{16}$

## Exercise 2-10

**Evaluate :**

1. a) $\frac{1}{2} \div \frac{3}{4}$ b) $\frac{2}{5} \div \frac{1}{3}$ c) $\frac{4}{7} \div \frac{9}{14}$ d) $\frac{7}{8} \div \frac{7}{16}$.
2. a) $3 \div \frac{1}{5}$ b) $7 \div \frac{1}{2}$ c) $1 \div \frac{1}{3}$ d) $4 \div \frac{1}{4}$.
3. a) $2\frac{1}{2} \div 3\frac{3}{4}$ b) $1\frac{7}{12} \div 3\frac{1}{6}$ c) $5\frac{2}{10} \div 2\frac{3}{5}$ d) $2\frac{1}{3} \div 4\frac{1}{5}$
4. a) $\frac{9}{13} \div 6$ b) $\frac{16}{21} \div 8$ c) $\frac{13}{20} \div 39$ d) $5\frac{3}{5} \div 14$
5. Complete the following :

Dividing a number by $\frac{2}{7}$ is the same as multiplying it by

6. A roll of ribbon is 24 m long. Find the number of pieces that can be cut off from that roll if each piece is $1\frac{1}{3}$m long.

7. A man travelled $3\frac{3}{5}$ km in 15 minutes. Find the distance travelled by him at the same speed in a minute.

8. The thickness of a book is $1\frac{1}{4}$ cm. Books of the same kind are kept one over the other to a height of $\frac{1}{2}$m. Find the number of books.

9. There is $38\frac{1}{4}$m cloth in a piece. Find the number of small pieces that can be cut off from that, if each small piece is of length $2\frac{1}{4}$m

10. $9\frac{3}{8}$ l. of oil is filled in 5 bottles of equal capacity. Find the capacity of one bottle.

**2-11. Problems involving the four operations :**

Study the examples carefully.

*(e. g.)* 1) $\frac{2}{5} \times \frac{5}{6} + \frac{2}{5} \times \frac{3}{4}$

$= \frac{2}{5}\left(\frac{5}{6} + \frac{3}{4}\right)$

$= \frac{2}{5}\left(\frac{10+9}{12}\right) = \frac{2}{5} \times \frac{19}{12}$

$= \frac{38}{60} = \frac{2 \times 19}{2 \times 30} = \frac{19}{30}$

2) $\frac{8}{15} \times \frac{9}{10} - \frac{8}{15} \times \frac{1}{10}$

$= \frac{8}{15}\left(\frac{9}{10} - \frac{1}{10}\right)$

$= \frac{8}{15} \times \frac{8}{10} = \frac{64}{150} = \frac{2 \times 32}{2 \times 75} = \frac{32}{75}$

3. A person spends $\frac{3}{5}$ of his salary on house-hold expenses. He deposits $\frac{1}{4}$ of it in a bank. He has Rs. 90 left with him. What is his salary?

Household expenses + savings

$$= \frac{3}{5} + \frac{1}{4} = \frac{12+5}{20} = \frac{17}{20} \text{ parts}$$

Balance left with him

$$1 - \frac{17}{20} = \frac{3}{20} \text{ parts}$$

$\frac{3}{20}$ parts of the salary = Rs. 90

$\therefore$ His salary = Rs. $90 \times \frac{20}{3}$ = Rs. 600

4. $\frac{7}{12}$ parts of the population of a village are males. Out of them $\frac{3}{4}$ are literates. The number of literate males is 2,800. Find the population of the village.

Males = $\frac{7}{12}$ parts.

Male literates = $\frac{3}{4}$ *of the males.*

$$= \frac{3}{4} \times \frac{7}{12} = \frac{21}{48} = \frac{3 \times 7}{3 \times 16} = \frac{7}{16} \text{ parts}$$

$\frac{7}{16}$ parts of the population = 2,800

Whole population = $2{,}800 \times \frac{16}{7} = 6{,}400$

**Exercise 2-11**

Simplify the following:

1. $\frac{5}{8} \times \frac{3}{4} + \frac{5}{8} \times \frac{2}{3}$
2. $\frac{7}{8} \times \frac{9}{10} - \frac{7}{8} \times \frac{3}{5}$
3. $3\frac{1}{4} \times 2\frac{1}{2} + 3\frac{1}{4} \times 4\frac{1}{2}$
4. $9\frac{1}{2} \times 1\frac{2}{5} - 6\frac{1}{3} \times 1\frac{2}{5}$

A man has Rs. 1000. He spends $\frac{3}{5}$ of it on household expenses, $\frac{1}{4}$ on miscellaneous items. $\frac{1}{10}$ on travel expenses and saves the remaining Find the amount he spends on each item How much does he save?

6. A person covers $\frac{2}{5}$ of the total distance by train, $\frac{3}{8}$ by bus and the rest on foot. The distance covered on foot is 9 km. Find the distance between the two places.

7 A person reads $\frac{1}{4}$ of a book on the first day, $\frac{3}{8}$ on the second day and $\frac{1}{5}$ on the third day. He has 28 pages more to complete the book. How many pages has the book?

8. Of the boys studying in a school $\frac{2}{15}$ are in Standard VI Out of them $\frac{5}{6}$ have succeeded in the examination and their strength is 60. Find the strength of the school.

9. A person owns $7\frac{1}{4}$ hectare of land. He sells $\frac{5}{29}$ of it for Rs. 6,250. Find the value of the entire land.

**2·12 Decimal Fractional Numbers :**

You know that 10 is the base used in our number system. In a number the place value of digits increase in powers of ten as we go from right to left.

For example, take the number 1,111. The digit 1 in the right extreme stands for one unit and the values of the other digits on the left are respectively 1 ten, 1 hundred and 1 thousand.

Thus $1111 = 1 \times 1000 + 1 \times 100 + 1 \times 10 + 1 \times 1$

If we go from left to right, note that the value of each digit is $\frac{1}{10}$th of the place on the left.

100 is $\frac{1}{10}$th of 1000

10 is $\frac{1}{10}$th of 100

1 is $\frac{1}{10}$th of 10

Can't we extend the place value further to the right after reaching the unit digit? As a result of such thinking **Decimal Fractional Numbers** came into use.

The Belgian Mathematician, **Simon Stein,** in his book **La Thiende** has explained how to write decimal fractions and how to solve problems using decimal fractions. He also wrote in detail the advantages constructing units of weight etc., based on the same principle.

If a digit is introduced after the units place it will indicate $\frac{1}{10}$ of the unit. Thus the place value can be extended as $\frac{1}{100}$, $\frac{1}{1000}$ and so on.

A point is introduced after the unit place to indicate that the value of the digits is less than one. This point is called **the decimal point.**

(e.g.) 152.648 is read as one hundred fifty two point six, four, eight. It means 1 hundred, 5 tens, 2 ones, 6 tenths, 4 hundredths and 8 thousandths.

0.15 means fifteen hundredths. 0.105 means one hundred five thousandths

(e.g.) 102.508 is read as one hundred two point five, zero, eight.

A decimal number can also be written in expanded notation.

(e.g.) $346.72 = 3 \times 100 + 4 \times 10 + 6 \times 1 + 7 \times \frac{1}{10} + 2 \times \frac{1}{100}$

or

$3 \times 10^2 + 4 \times 10 + 6 \times 1 + 7 \times \frac{1}{10} + 2 \times \frac{1}{10^2}$

Observe the following number ray.

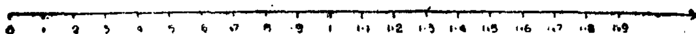


Fig.2·18

In this every unit is divided into ten equal parts and each part is ·1 of the unit.

**Practical :** Take a graph sheet of length 5cm and **breadth 2cm. Each** square cm is divided into 100 small squares. As there are **10sq.** cms there are 1,000 small squares or 1,000 sq. mm. **Learn to** make a few decimal fractions on the graph paper.

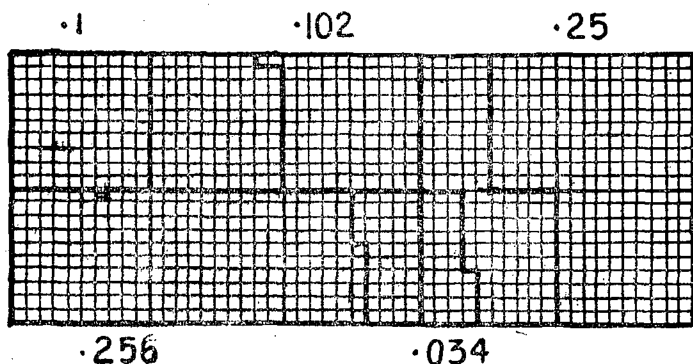



Fig. 2-19

Note that the following decimal fractions have been marked on the graph paper above :

·1; ·102; ·25; ·034; ·102; ·256

(Note that ·1 = $\frac{100}{1000}$)

**2·13 (A) Changing decimal Fractions into ordinary fractions :**

(e. g.) 3·62 = 3 ones + 6 tenths + 2 hundredths

$= 3 \times 1 + 6 \times \frac{1}{10} + 2 \times \frac{1}{100}$

$= 3 + \frac{6}{10} + \frac{2}{100} = \frac{300}{100} + \frac{60}{100} + \frac{2}{100} = \frac{362}{100}$

In the same way any decimal fraction can be changed into an ordinary fraction.

**(B) Changing ordinary fractions into decimal fractions :**

(e. g.) $2\frac{637}{1000} = \frac{2637}{1000} + \frac{2000}{1000} + \frac{600}{1000} + \frac{30}{1000} + \frac{7}{1000}$

$= 2 + \frac{6}{10} + \frac{3}{100} + \frac{7}{1000}$

$2 + \cdot6 + \cdot03 + \cdot007 = 2\cdot637$

In the same way any ordinary fraction can be changed into decimal fraction.

**2·14 Learn :**

(a) ·42 and ·042 differ in their values - Why?

$\cdot42 = \frac{42}{100}$; $\cdot042 = \frac{42}{1000}$

Therefore ·42 > 042

(b) ·42 and ·420 do not differ in their values - Why?

$\cdot42 = \frac{42}{100}$ ; $\cdot420 = \frac{420}{1000} = \frac{42}{100}$

Therefore ·42 = ·420

From the following figures we learn that. ·5 and ·50 are the same.

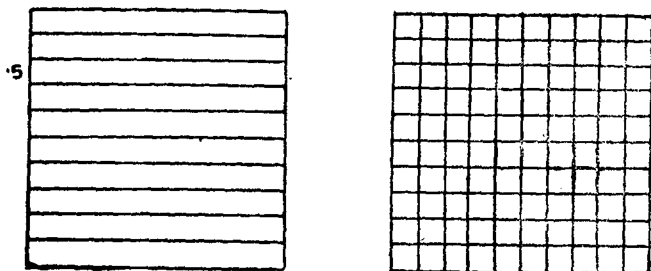



Fig. 2-20

Thus we understand that the Zero placed on the right of the decimal fraction bears no value.

(c) $\cdot 6 = \frac{6}{100} = \frac{600}{1000}$; $\cdot 527 = \frac{527}{1000}$

Since $\frac{600}{1000}$ is greater, we find $\cdot 6 > \cdot 527$

$\cdot 6 = \cdot 600$

$\cdot 527 = \cdot 527$

Therefore ·6 is greater i. e. $\cdot 6 > \cdot 527$

(d) 1m = 100cm and so 1cm = ·01m

1m = 10dm and so 1dm = ·1m

1km = 1000m and so 1m = ·001km

Similarly we may convert lower units into decimals of higher units.

4m 3dm 5cm = 4·35m.

1kg 275g. = 1·275kg

Learn, express, measure in the same way.

(e.g.) $\frac{2}{5} = \frac{4}{10} = \cdot 4$

$\frac{5}{8} = \frac{625}{1000} = \cdot 625$

From the above examples we learn that the denominators are changed into powers of ten for converting into decimal form.

## Exercise 2-12

1. Write in numerals :

(a) Eighty hundred fifty six thousandths

(b) Eightysix and four tenths and five thousandths.

(c) One hundred ten and three thousand four hundred nine thousandths.

(d) Twenty eight and three hundred seven thousandths.

2. Read the following :

(a) 8·543 (b) 18·607 (c) 30·0708 (d) 105·4321

3. Write as decimal fractions:

(a) $5\times10+4\times1+7\times\frac{1}{10}+6\times\frac{1}{100}+2\times\frac{1}{1000}$

(b) $8\times100+5\times1+2\times\frac{1}{10}+7\times\frac{1}{1000}+9\times\frac{1}{10000}$

(c) $3\times100+4\times10+5\times\frac{1}{100}+6\times\frac{1}{1000}+7\times\frac{1}{10000}$

(d) $2\times10+9\times1+4\times\frac{1}{10}+3\times\frac{1}{1000}+5\times\frac{1}{10000}$

4. Write as decimal fractions:

(a) $6\times10^2+3\times10+4\times1+2\times\frac{1}{10}+4\times\frac{1}{10^4}+5\times\frac{1}{10^6}$

(b) $2\times10+8\times1+3\times\frac{1}{10}+5\times\frac{1}{10^2}+6\times\frac{1}{10^4}$

(c) $4\times10^2+7\times1+6\times\frac{1}{10}+1\times\frac{1}{10^3}$

(d) $8\times10^2+2\times10+3\times1+4\times\frac{1}{10}+6\times\frac{1}{10^2}+7\times\frac{1}{10^4}$

5. Insert = or > or < between the numbers in each pair.

(a) ·71, ·710 (b) ·62, ·062 (c) ·549, ·7

(d) ·009, ·02 (e) ·018, ·18 (f) ·9, ·819

6. Write in the ascending order:

·62; ·062; ·602; ·6; ·61

7. Write in the descending order:

·81; ·801; ·081; ·0801; ·8

8. Rewrite as decimal fractions:

(a) $2\frac{7}{10}$ (b) $3\frac{14}{100}$ (c) $5\frac{108}{1000}$ (d) $9\frac{3}{1000}$ (e) $10\frac{17}{100}$

9. Rewrite as decimal fractions :

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{2}{5}$ (d) $\frac{3}{4}$ (e) $\frac{3}{8}$

10. Rewrite as ordinary fractions :

(a) 6·205 (b) 17·048 (c) 30·054 (d) 12·345

11. Write the given measure as a decimal fraction of the measure in the brackets.

(a) 7cm (metre) (b) 65g (kg) (c) 125ml. (litre)
(d) 108 m (km) (e) 40p. (Re)

12. Express as directed.

(a) 7m 1dm 5cm (in metres) (b). 1kg 75g (in kg)
(c) 1 l 200ml (in litres) (d) 3Rs. 8p (in Rs)
(e) 3hm 4dam 7m (in km)

**2-15. Addition and subtraction in decimal fractions :**

Addition and subtraction of decimal fractions can be done as in whole numbers, for the decimal fractions too have the place values based on the idea of whole numbers.
Observe the following example.

Add : 4·372 + 2·05 + 3·4621 + 7·234 + 5·008.

| Tens | Ones | tenths | hundredths | thousandths | ten thousandths |
|---|---|---|---|---|---|
| | 4 | 3 | 7 | 2 | 0 |
| | 2 | 0 | 5 | 0 | 0 |
| | 3 | 4 | 6 | 2 | 1 |
| | 7 | 2 | 3 | 4 | 0 |
| | 5 | 0 | 0 | 8 | 0 |
| 2 | 2 | 1 | 2 | 6 | 1 |

Ans · 22·126

The same sum has been explained with decimal point :

4·372
2·05
3·4621
7·234
5·008

22·1261 Ans : 22·1261

**Note :** (1) Keep the decimal points in a vertical order as shown above.

(2) Zeros can be placed on the right of the decimal fractions to equalise the number of decimal digits. (The Zeros at the end of decimals do not alter the value of the decimal fraction).

(e.g.) 4·3720
2·0500
3·4621
7·2340
5·0080

22·1261

**(e.g ) Subtract 13·508 from 26·2**

| tens | ones | tenths | hundredths | thousandths |
|---|---|---|---|---|
| 2 | 6 | 2 | 0 | 0 |
| 1 | 3 | 5 | 0 | 8 |
| 1 | 2 | 6 | 9 | 2 |

**(Note that the rules followed in the previous sum are applicable to this one also)**

26·200
13·508

12·692

**Note:** By changing the decimal fractions into ordinary fractions the above answers can be verified.

## Exercise 2·13

Find the value of:

1. (a) 0·52 + 0·052 (b) 4·7 + 0·47 (c) 35 + 0·035
   (d) 12 + 1·23

2. (a) 8·003 + 1·109 (b) 24·52 + 3·097
   (c) 16·1 + 7·098 (d) 102 + 2·079

3. (a) 6·72 + 7·01 + 152·4 + 3·057 + 1·0208
   (b) 9·08 + 16·54 + 76·901 + 100·2 + 3·657
   (c) 218·05 + 324·92 + 18·761 + 7·5009 + 10·056
   (d) 39 + 107·51 + 24·326 + 1·0287 + 3·456

4. The lengths of four pieces of a rope are 2·5m, 5·08m; 3m and 4·125m. Find the total length.

5. The rain fall in a certain place in six days in the month of october was as follows:
   4·72cm; 0·84cm; 5·2cm; 4cm; 0·08cm and 6·25cm.
   Find the total amount of rain fall.

6. The population of a State according to the census is as follows; Hindus 499·87 Lakh; Muslims 46·241 Lakh; Christians 25·764 Lakh; Jains 0·123 Lakh; others 0·002 Lakh. Find the total population of the state.

7. Find the value of: (a) 8·54 − 3·38 (b) 9·63 − 2·56
   (c) 16·02 − 7·54 (d) 92·1 − 16·94

8. Find the vaule of: (a) 16·5 − 7·34 (b) 20·1 − 13·62
   (c) 54·12 − 38·097 (d) 65·2 − 24·108

9. Find the value of: (a) 0·23 − 0·023 (b) 3·75 − 0·375
   (c) 100-9·764 (d) 1-0·040

10. The value of goods produced in a factory in a month was Rs. 82.56 Lakh. The production went down by Rs. 4.725 lakh the next month. Find the value of goods produced in lakhs in the second month.

11. The area of wet lands in a village is 1647·25 hectare. If the area of the dry-lands is less by 1012·5 hectare than the wet lands, find the area of the dry lands. What is the total area?

12. Out of 2·5 km of a highway distance 1·175 km is tarred. What distance is yet to be tarred?

13. Simplify:
   (a) $7{\cdot}324+6{\cdot}02-10{\cdot}6192+5{\cdot}6$
   (b) $24{\cdot}5+126{\cdot}32-80{\cdot}764-20{\cdot}089$
   (c) $158{\cdot}4-16{\cdot}7-28{\cdot}34-15{\cdot}987$
   (d) $1000-114{\cdot}02+36{\cdot}98+796{\cdot}542$

14. In a shop 2565 kg. of coffee seeds were sold on the first day. The sale on the second day was 12.75kg. more than that on the first day and the sale on the third day was 24.8kg less than that on the second day. Find the total quantity of coffee seeds sold on the whole.

15. A man gave ·25 of his property to his wife, ·125 to his daughter, ·01 to charity and the remaining part to his son. What part did his son get?

**2·16. 1. Multiplication of a decimal fraction by 10, 100 and 1,000**

Example: Find the value of: $16{\cdot}54\times10$

$$16{\cdot}54=10+6+\tfrac{5}{10}+\tfrac{4}{100}$$

$$16{\cdot}54\text{X}10=10\text{X}10+6\text{X}10+\tfrac{5}{10}\text{X}10+\tfrac{4}{100}\text{X}10$$

$$=100+60+5+\tfrac{4}{10}$$

$$=165{\cdot}4$$

The above sum can also be done as follows:

$$16{\cdot}54\times10=\tfrac{1654}{100}\times10=\tfrac{1654}{10}=165{\cdot}4$$

Thus we learn that the decimal point is shifted to the right by one place if the decimal fraction is to be multiplied by 10.

In the same way to multiply a decimal fraction by 100 and by 1,000, the decimal points are shifted 2 places and 3places to the right respectively.

Example : $2{\cdot}345 \text{X} 100 = \frac{2345}{1000} \times 100 = \frac{2345}{10} = 234{\cdot}5$

$6{\cdot}7214 \text{X} 1000 = \frac{67214}{10000} \times 1000 = \frac{67214}{10}$ $6721{\cdot}4$

**To multiply a decimal point by any power of ten, move the decimal point as many places to the right as there are zeros in the multiplier.**

**2-16.2** Division of decimal fractions by 10,100 and 1,000.

**Example :** Divide 62·38 by 10

You know that $6{\cdot}238 \text{X} 10 = 62{\cdot}38$

From this we learn that $62{\cdot}38 \div 10 = 6{\cdot}238$

The sum can also be done as follows :

$$\frac{62{\cdot}38}{10} = \frac{6238}{100} \times \frac{1}{10} = \frac{6238}{1000} = 6{\cdot}238$$

To divide a decimal fraction by ten, move the decimal point one place to the left.

In the same manner, we may find that, when we divide a decimal fraction by 100 and 1,000, the decimal point will be shifted 2 places and 3 places respectively to the left.

**Example** : $352{\cdot}5 \div 100 = \frac{3525}{10} = \frac{1}{100} = \frac{3525}{1000} \times 3{\cdot}525$

$$4728{\cdot}2 \div 1000 = \frac{47282}{10} \times \frac{1}{1000} = \frac{47282}{10000} = 4{\cdot}7282$$

**In general to divide a decimal or a whole number by 10 or a power of ten, we move the decimal point as many places to the left as there are zeros in the division.**

Thus

$0{\cdot}32 \div 100 = {\cdot}0032$

and

$42{\cdot}64 \div 1000 = {\cdot}04264$

## Exercise 2-14

1. Find the products and fill in the blanks :

| | Decimal fraction | × 10 | × 100 | × 1000 |
|---|---|---|---|---|
| (a) | 5·62 | | | |
| (b) | 7·041 | | | |
| (c) | 27·0284 | | | |
| (d) | 586·27 | | | |
| (e) | 450·6431 | | | |

2. Fill in the blanks :

(a) $65{\cdot}48 \times 10 = \ldots$ (b) $102{\cdot}05 \times 100 = \ldots$

(c) ${\cdot}042 \times 1000 = \ldots$ (d) ${\cdot}002 \times 100 = \ldots$

(e) ${\cdot}1004 \times 1000 = \ldots$ (f) ${\cdot}047 \times 10 = \ldots$

3. Find the least powers of ten which, when multiplied will change the following into whole numbers.

(a) 2·5 (b) ·002 (c) ·102 (d) 4·65 (e) 18·721

(f) 0·0008

4 What is the length of the iron-rod that has been cut off into 100 pieces of length 30·48 cm each?

5. Find the cost of 100 kg of onion at the rate of 0.65 Re. a kg.

6. Fill in the blanks :

| | Decimal fraction | ÷10 | ÷100 | ÷1000 |
|---|---|---|---|---|
| (a) | 432·7 | | | |
| (b) | 7986·52 | | | |
| (c) | 201·35 | | | |
| (d) | 62·05 | | | |
| (e) | 0·7 | | | |

7. Fill in the blanks :

(a) 16·25÷... = 1·625

(b) 274·1 ÷...=2·741

(c) ·3 ÷...= ·003

(d) 2·1 ÷...=·021

(e) 16 ÷...=·016

8. Fill in the blanks :

(a) 724·5 ÷10=...

(b) 908·21÷100 = ...

(c) 4176·41÷1000=...

(d) 27·69÷100=...

(e) 32·54÷100=...

(f) 6·2 ÷1000=...

9. A cricketer made 764 runs in 10 innings. What is the average number of runs scored by him?

10. 100 note-books of equal thickness are kept one over the other. The total height is 1·25m. What is the thickness of each note-book. (Give your answer in cm.)

**2-17. Multiplication of decimal fractions by whole numbers and by decimal fractions :**

**Example 1:** Find the product of $5{\cdot}26 \times 12$

$$\frac{5{\cdot}26 \times 12}{63{\cdot}12}$$

6 hundredths multiplied by 12 gives 72 hundredths.
72 hundredths = 7 tenths + 2 hundredths.
2 is written in hundredths place.

2 tenths multiplied by 12 gives 24 tenths and added with 7 tenths gives 31 tenths.

31 tenths = 3 + 1 tenth.
1 is written in tenths place.

5 multiplied by 12 and added with 3 gives 63.
So the product is 63·12

The same sum can be done as:

$$5{\cdot}26 \times 12 = \frac{526}{100} \times 12 = \frac{6312}{100} = 63{\cdot}12$$

**Example 2:** Find the value of: $9{\cdot}72 \times 4{\cdot}8$

$$\frac{972}{100} \times \frac{48}{10} = \frac{46656}{1000} = 46{\cdot}656$$

**Example 3:** $\cdot 3 \times \cdot 02 = \frac{3}{10} \times \frac{2}{100} = \frac{6}{1000} = \cdot 006$

From the above, we learn that the multiplication of decimal fraction is similar to the multiplication of whole numbers. **When two decimal fractions are multiplied, the number of decimal places in the product is equal to the total number of decimal places in the two multipliers.**

## Exercise 2-15

1. Find the value of :

   (a) $7{\cdot}4 \times 8$ (b) $26{\cdot}93 \times 12$ (c) $45{\cdot}68 \times 20$

   (d) $16{\cdot}345 \times 11$ (e) $1{\cdot}23 \times 2{\cdot}76$ (f) $2{\cdot}35 \times 48$

2. Find the value of $7245 \times 24$ and answer the following :

   (a) $7{\cdot}245 \times 2{\cdot}4$ (b) $7{\cdot}245 \times 2{\cdot}4$ (c) $7{\cdot}245 \times {\cdot}24$

   (d) $724{\cdot}5 \times .024$ (e) $7{\cdot}245 \times 2{\cdot}4$

3. Find the value of $5278 \times 132$ and answer the following :

   (a) $5{\cdot}278 \times 132$ (b) $52{\cdot}78 \times 13{\cdot}2$ (c) $527{\cdot}8 \times 13{\cdot}2$

   (d) $52{\cdot}78 \times {\cdot}132$ (e) $5{\cdot}278 \times {\cdot}0132$

4. Find the value of :

   (a) $28{\cdot}72 \times 31{\cdot}4$ (b) $1002{\cdot}8 \times 13{\cdot}1$ (c) $1{\cdot}2 \times 0{\cdot}4 \times 8{\cdot}3$

   (d) $0{\cdot}064 \times 0{\cdot}008$ (e) $1{\cdot}6 \times 2{\cdot}4 \times 3{\cdot}2$

5. Find the value of :

   (a) $1{\cdot}02 \times 2{\cdot}1 \times 3{\cdot}4$

   (b) $0{\cdot}7 \times 0{\cdot}2 \times 0{\cdot}1$

   (c) $305{\cdot}247 \times 8{\cdot}3$

   (d) $16{\cdot}2471 \times 9{\cdot}5$

   (e) $7{\cdot}2348 \times 11{\cdot}2$

6. The weight of a box is 4·25 kg. What is the weight of 18 such boxes?

7. The thickness of a book is 2·54cm. What will be the height of a pile of 25 such books?

8. A basket contains 12·25 kg of potatoes. Find its cost at Rs.1·20 a kg.

### 2-18 Approximation of decimal fractions :

Have you seen the instrument used by your physical education teacher to measure your height. In the absence of such an

instrument the teacher marks the measurement on the wall and asks you to stand by the wall. A boy places a ruler in level with your head and finds your height. Say your height is in between 1m 16cm and 1m 17cm. If it is nearer to 1m 16 cm your height is taken as 1m 16cm and if it is nearer to 1m 17cm your height is taken as 1m 17cm. In both the cases it is only an approximate measurement correct to a cm.

Let us take another example. Look at the number ray given below




Fig 2-21

The given point is between 10 and 11. But as it is nearer to 11 its approximate value **correct to a whole number is 11**

When we buy things or prepare a price list, if the fraction of paise is less than a half we leave it and when it is equal to or more than a half, we take it as one paise.

Approximation helps us

(i) In estimation of computations.

(ii) In giving approximate measurements.

(iii) To know the number of digits in the answer.

Observe the given number ray :

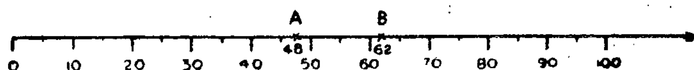



Fig. 2-22

A represents 48 which lies between 40 and 50. The distance between A and 40 is 8 and the distance between A and 50 is 2.

Hence the number 50 which is nearer to A is the approximate value of A correct to tens. Likewise B stands nearer to 60 and its approximate value is 60 correct to tens.

Thus we understand that the numbers from 6 to 14 lie nearer to 10 the numbers from 16 to 24 lie nearer to 20, the numbers from 26 to 34 lie nearer to 30.

5 is equidistant from 0 and 10. But its approximate value is taken as 10.

Similarly 15 is taken as 20,25 as 30 and so on.

Now let us learn how approximation helps us in decimal fractions.

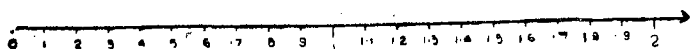


Fig. 2-23

In the given number ray note that the decimal fractions between ·5 and 1·5 lie nearer to 1 and that their approximate value is 1. So also the decimal fractions between 1·5 and 2·5 lie nearer to 2 and their approximate value correct to a whole number is 2. 0·5 is equidistant from 0 and 1. But it is taken as 1. Similarly 1·5 is taken as 2 and so on.

From these we learn :

To write a whole number or a decimal fraction correct to a given place;

(a) if it is less than 5, ignore it along with the numbers to the right of it.

(b) if it is greater than 5 or equal to 5, increase the digit by one at the required place.

(e.g.) 7·38 = 7·4 (correct to the first decimal place)
5·432 = 5·43 (correct to the second decimal place)
84 = 8tens (correct to a ten)
4·9 = 5 (correct to a unit)

## EXERCISE 2-16

1. Round to the nearest tenth.

   (a) 4·502 (b) 12·714 (c) 23·675

   (d) 35·962 (e) 19·835

2. Round to the hundredth the following numbers :

   (a) 14·728 (b) 15·393 (c) 8·6555

   (d) 1·4009 (e) 2·5014

3. (a) Rs. 4·738 — (correct to paise)

   (b) 8·543 m — (correct to a cm)

   (c) 6·5894 l — (correct to a ml)

   (d) 5·4082 kg — (correct to a gram)

## 2.19 Division of decimal fractions :

**Example :**

Divide 18·62 by 7

$$7 \,|\, \underline{18{\cdot}62}$$
$$2{\cdot}66$$

18 divided by 7 gives a quotient of 2 and a remainder of 4. Since $4 = \frac{40}{10}$ convert 4 into 40 tenths and add 6 tenths.

46 tenths divided by 7 gives 6 tenths as quotient 4 tenths as remainder. 4 tenths are converted into 40 hundredths and added with 2 hundredths. Now 42 hundredths divided by 7 gives 6 hundredths as quotient.

∴ 2·66 is the quotient.

**Example 2:**

Divide 4·5 by 8

$$8 \,|\, \underline{4 \cdot 5000}$$
$$0 \cdot 5625$$

The division has been performed as in the previous example. Note that the required number of zeros are placed to the right of the last decimal digit.

Decimal fractions can be converted into ordinary fractions and division can be carried out as follows :

$$\frac{18 \cdot 62}{7} = \frac{1}{7} \times 18 \cdot 62 = \frac{1}{7} \times \frac{1862}{100} = \frac{266}{100} = 2 \cdot 66$$

$$\frac{4 \cdot 5}{8} = \frac{1}{8} \times 4 \cdot 5 = \frac{1}{8} \times \frac{45}{10} = \frac{1}{8} \times \frac{45000}{10000}$$

$$\frac{5625}{10000} = \cdot 5625$$

**To divide a decimal fraction by a whole number, proceed as with whole numbers, but place the decimal point in the quotient directly above the decimal point in the dividend.**

*(e.g.)* Divide 7·2 by 4

$7 \cdot 2 \div 4 = (7 \cdot 2 \times 10) \div (\cdot 4 \times 10) = 72 \div 4 = 18$
Converting them into ordinary fractions :

$$\frac{7 \cdot 2}{0 \cdot 4} = \frac{7 \cdot 2 \times 10}{0 \cdot 4 \times 10} = \frac{72}{4} = 18$$

(e.g.) Divide 8·4 by 03

$$\frac{8\cdot4}{\cdot03} = \frac{8\cdot4\times100}{\cdot03\times103} = \frac{840}{3} = 280$$

(e.g.) Divide 5·6 by ·014

$$\frac{9\cdot5}{\cdot014} = \frac{5\cdot6\times1000}{\cdot014\times1000} = \frac{5600}{14} = 400$$

From the above examples we learn :

(i) To divide a decimal fraction by another decimal fraction find out the least power of ten which makes the divisor a whole number.

(ii) Multiply both the dividend and the divisor by that power of ten.

(iii) Then the division of a decimal fraction by another becomes a division by a whole number.

(e.g.) $\frac{2\cdot5}{3} = \cdot8333\ldots.$ In case of such non-terminating decimal fractions give the quotient correct to the required number of places.

Hence $2\cdot5\div3=\cdot83$ (correct to the second decimal place)

(e.g.) Divide 51·3 by 90

$$51\cdot3\div90=(51\cdot3\div10)\div9=5\cdot\dot{1}3\div9=0\cdot57$$

**When a decimal fraction is to be divided by a multiple of ten the divisor is first divided by the power of ten and then the quotient is divided by the whole number.**

**Exercise 2-17**

Find the value of :

1 (a) $6\cdot51\div7$ (b) $0\cdot192\div12$

(c) 66·306 ÷ 6 (d) 14·968 ÷ 4

(e) 90·1845 ÷ 9 (f) 15·355 ÷ 5

**2.** (a) 2·1 ÷ 4 (b) 35·3 ÷ 8 (c) 15·435 ÷ 7

(d) 1·9845 ÷ 9 (e) 24·5 ÷ 16 (f) 2·538 ÷ 5

**3.** (a) 18·9 ÷ ·3 (b) 16·1 ÷ ·04

(c) 4·25 ÷ 0.05 (d) 57·6 ÷ ·144

(e) 14·88 ÷ 1·2 (f) 16·8 ÷ 3·5

**4.** Give the answer correct to the hundredth place :

(a) 16 ÷ 3 (b) 24 ÷ 7 (c) ·61 ÷ 11

(d) ·095 ÷ 1·3 (e) 1000 ÷ 9 (f) 150 ÷ 1·1

**5.** Find the value of :

(a) 21·12 ÷ 40 (b) 907·2 ÷ 600

(c) 504·18 ÷ 90 (d) 1·96 ÷ .007

(e) 172·45 ÷ 13 (correct to the hundredth place)

**6.** The product of two decimal numbers is 20·616. If one of them is 2.4 find the other.

**7.** If the wheel of a motor car covers a distance of 33·75m in 18 revolutions find the distance covered by the wheel in one revolution.

**8.** 7 shirts cost Rs. 282·45. Find the cost of a shirt.

**9.** The height of 30 planks of equal thickness piled one upon another is 38·1 cm. Find the thickness of a plank.

**10.** The total weight of 25 copies of a book is 32·525 kg. What is the weight of each copy?

## ANSWERS

### Exercise 2-1

1. (i) $\frac{1}{4}$ (ii) $\frac{1}{2}$ (iii) $\frac{5}{30}$ (iv) $\frac{2}{5}$ (v) $\frac{3}{8}$ (vi) $\frac{1}{2}$ (vii) [illegible] (viii) $\frac{1}{9}$

2. Any natural number can be considered as a fractional number with denominator 1.

3. (a) $5\frac{4}{5}$ (b) $1\frac{2}{3}$ (c) $1\frac{3}{4}$ (d) $1\frac{6}{7}$

4. (a) $\frac{3}{2}$ (b) $\frac{4}{3}$ (c) $\frac{8}{5}$ (d) $\frac{10}{9}$

5. Yes; zero can be considered as a fractional number with 1 as denominator.

## Exercise 2-2

1. (i) Proper (ii) Improper (iii) Proper (iv) Improper (v) Mixed (vi) Mixed (vii) Proper (viii) Improper

3. (a), (b), (d) are in the simplest form
(c) $\frac{2}{3}$ (e) $\frac{1}{3}$ (f) $\frac{1}{2}$

4. (a) $\frac{11}{24}$ (b) $\frac{32}{45}$ (c) $\frac{3}{4}$ (d) $\frac{8}{11}$

6. (a) $\frac{25}{100}$ (b) $\frac{20}{100}$ (c) $\frac{700}{1000}$ (d) $\frac{400}{1000}$ (e) $\frac{8}{10}$
(f) $\frac{600}{1000}$ (g) $\frac{144}{1440}$ (h) $\frac{48}{144}$.

7. (a) $\frac{15}{4}$p. (b) $\frac{20}{3}$p. (c) $\frac{85}{2}$p.

8. (a) $\frac{7}{9}$ (b) $\frac{7}{11}$ (c) $\frac{3}{4}$ (d) $\frac{3}{4}$

9. (a) $\frac{9}{24}$, $\frac{20}{24}$.

10. $\frac{18}{21}$, $\frac{18}{26}$.

11. (a) $4\frac{1}{5}$ b) $2\frac{2}{3}$ (c) $5\frac{6}{10}$ (d) $7\frac{2}{9}$ (e) $5\frac{10}{17}$.

12. (a) $\frac{7}{3}$ (b) $\frac{19}{5}$ (c) $\frac{43}{10}$ (d) $\frac{32}{7}$ (e) $\frac{52}{11}$

## Exercise 2-3

1. (a) $\frac{7}{8}$ (b) $\frac{7}{11}$ (c) $\frac{4}{5}$ (d) $\frac{4}{5}$ (e) $\frac{18}{13}$ (f) $\frac{8}{9}$ (g) [illegible]
(h) $\frac{7}{9}$ (i) $\frac{12}{15}$.

2. (a) $\frac{4}{9}$ (b) $\frac{5}{7}$ (c) $\frac{9}{11}$ (d) $\frac{8}{9}$ (e) $\frac{4}{13}$ (f) $\frac{12}{17}$ (g) [illegible]
(h) $\frac{5}{6}$ (i) $\frac{9}{10}$.

3. (a) 8 roses for 30p. (b) 9 fruits for 75p.
   (c) 11dolls for Rs. 24
   (a) (b)

4. (a) greatest $\frac{5}{8}$ least $\frac{1}{2}$.
   (b) greatest $\frac{5}{6}$; least $\frac{4}{9}$.

5. $\frac{3}{8}$, $\frac{13}{20}$, $\frac{3}{5}$, $\frac{3}{4}$, $\frac{4}{5}$.

6. $\frac{7}{8}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{9}{16}$, $\frac{17}{32}$.

7. Acid with $\frac{2}{3}$ parts water.

8. 32 out of 50.

## Exercise 2-4

1. (a) $\frac{4}{3}+\frac{4}{3}=\frac{8}{3}$ (b) $\frac{3}{5}+\frac{6}{5}=\frac{9}{5}$.

2. (a) $\frac{1}{8}+\frac{2}{8}+\frac{3}{8}=\frac{6}{8}$ (b) $\frac{1}{10}+\frac{3}{10}+\frac{3}{10}=\frac{7}{10}$

3. (a) 2 (b) 2 (c) $2\frac{2}{3}$ (d) $1\frac{3}{11}$

4. (a) $\frac{5}{6}$ (b) $1\frac{7}{12}$ (c) $1\frac{1}{4}$ (d) $1\frac{11}{36}$ (e) $1\frac{1}{18}$ (f) $\frac{13}{15}$

5. (a) $\frac{5}{8}$ (b) $\frac{29}{30}$ (c) $1\frac{73}{80}$ (d) $1\frac{5}{18}$

6. (a) $3\frac{3}{4}$ (b) $5\frac{9}{10}$ (c) $8\frac{3}{5}$ (d) $6\frac{47}{100}$

7. (a) $10\frac{11}{15}$ (b) $7\frac{5}{16}$ (c) $12\frac{19}{60}$ (d) $9\frac{17}{42}$

8. $\frac{17}{20}$; 9. $\frac{29}{60}$

## Exerciso 2-5

1. (a) $\frac{7}{4}-\frac{3}{4}=\frac{4}{4}$ (b) $\frac{13}{8}-\frac{5}{8}=\frac{8}{8}=1$

2. (a) $\frac{2}{8}$ (b) $\frac{3}{8}$ (c) $\frac{6}{11}$

3. (a) $\frac{1}{5}$ (b) $\frac{1}{8}$ (c) $\frac{1}{10}$

4. (a) $1\frac{7}{24}$ (b) $3\frac{1}{63}$ (c) $3\frac{3}{4}$

5. $3\frac{1}{15}$

6. $9\frac{3}{10}$

7. $5\frac{1}{4}$m

8. (a) $1\frac{1}{4}$ (b) $2\frac{9}{10}$ (c) $3\frac{1}{3}$ (d) $3\frac{2}{3}$

### Exercise 2-6

1. (a) 3 (b) $7\frac{1}{30}$ (c) $4\frac{3}{16}$ (d) $11\frac{31}{40}$ (e) $4\frac{17}{48}$ (f) $48\frac{1}{8}$

2. $4\frac{1}{18}$ (3) 2m (4) $\frac{1}{10}$ (5) $\frac{5}{16}$ (6) $9\frac{23}{30}$ (7) $\frac{1}{4}$

### Exercise 2-7

1. (a) $2\frac{2}{5}$ (b) $2\frac{2}{7}$ (c) $6\frac{3}{10}$ (d) $3\frac{9}{11}$

2. (a) $7\frac{1}{2}$ (b) $4\frac{1}{2}$ (c) $8\frac{1}{3}$ (d) $16\frac{1}{2}$ 3. (a) $9\frac{3}{4}$ (b) $16\frac{2}{3}$ (c) $12\frac{3}{4}$ (d) $10\frac{15}{16}$ 4. (a) $24\frac{1}{2}$ (b) 21 (c) $84\frac{3}{4}$ (d) $74\frac{9}{11}$ 5. (a) 5 (b) 7 (c) 11 (d) 31

6. Rs. $9\frac{3}{5}$ 7. 132pages 8. For transports Rs. 50; For food Rs. 200. 9. $26\frac{2}{5}$ kg. 10. 147

### Exercise 2-8

1. (a) $\frac{12}{35}$ (b) $\frac{10}{27}$ (c) $\frac{56}{91}$ (d) $\frac{14}{33}$ 2. (a) $\frac{1}{6}$ (b) $\frac{3}{8}$ (c) $\frac{1}{6}$ (d) $\frac{1}{6}$ 3. (a) $1\frac{1}{8}$ (b) $\frac{3}{4}$ (c) $2\frac{4}{5}$ (d) $\frac{3}{4}$

4. (a) $7\frac{7}{8}$ (b) $15\frac{15}{16}$ (c) 19 (d) $21\frac{2}{3}$

5. (a) $\frac{1}{4}$ (b) $\frac{3}{10}$ (c) $\frac{1}{4}$ (d) $\frac{2}{9}$

6. Rs. 3 7. Rs. $18\frac{3}{5}$ 8. $22\frac{13}{16}$ 9. $43\frac{3}{4}$

### Exercise 2-9

(1) $\frac{8}{7}$ (2) $\frac{9}{5}$ (3) 1 (4) $\frac{6}{4}$ (5) $\frac{5}{8}$ (6) $\frac{3}{5}$, $\frac{1}{3}$

(7) 1 (8) (a) $\frac{5}{2}$ (b) $\frac{8}{3}$ (c) $\frac{4}{1}$ (d) $\frac{8}{1}$ (e) $\frac{10}{1}$ (f) $\frac{3}{5}$ (g) $\frac{3}{10}$ (h) $\frac{1}{2}$ (i) $\frac{1}{7}$ (j) $1\frac{1}{4}$

(9) (a) $\frac{11}{6}$ (b) $\frac{1}{4}$ (c) $\frac{10}{7}$ (d) $\frac{1}{3}$

### Exercise 2-10

1. (a) $\frac{8}{3}$ (b) $1\frac{1}{5}$ (c) $\frac{8}{9}$ (d) $\frac{6}{7}$ 2. (a) 15 (b) 14 (c) 3 (d) 16

3. (a) $-\frac{2}{3}$ (b) $\frac{1}{3}$ (c) 2 (d) $\frac{7}{12}$
4. (a) $\frac{3}{28}$ (b) $\frac{2}{21}$ (c) $\frac{1}{40}$ (d) $\frac{2}{5}$
5. $\frac{7}{9}$ 6. 16 pieces. 7 $\frac{6}{25}$ km 8. 40 books
9. 17 pieces. 10. $1\frac{7}{8}$ l

## Exercise 2-11

1. $1\frac{13}{72}$ (2) $\frac{21}{80}$ (3) $21\frac{14}{16}$ (4̄) $5\frac{29}{32}$ (5) House expenses Rs 400; Miscellaneous Rs. 250; Travel expense Rs. 100; Savings Rs. 250. (6) 40 km. (7) 160 pages. (8) 540 students (9) Rs 36,250

## Exercise 2-12

1. (a) 0·856 (b) 86·405 (c) 110·3409 (d) 28·0307

2. (a) Eight + 5 tenths + 4 hundredths + 3 thousandths.
   (b) Eighteen + 6 tenths + 7 thousandths.
   (c) Thirty + 7 hundredths + 8 thousandths.
   (d) One hundred five + 4 tenths + 3 hundredths + 2 thousandths + 1 ten thousandth.

3. (a) 54·762 (b) 805·2079 (c) 340·0567 (d) 29·4035

4. (a) 634·245 (b) 28·3506 (c) 407·601 (d) 823·467

5. (a) $\cdot71 = \cdot710$ (b) $\cdot62 > \cdot062$ (c) $\cdot549 < \cdot7$ (d) $\cdot009 < \cdot02$ (e) $\cdot018 < \cdot18$ (f) $\cdot9 > \cdot819$

6. $\cdot062 < \cdot6 < \cdot602 < \cdot61 < \cdot62$

7. $\cdot81 > \cdot801 > \cdot8 > \cdot081 > \cdot0801$

8. (a) 2·7 (b) 3·14 (c) 5·108 (d) 9·003 (e) 10·17

9. (a) ·5 (b) ·25 (c) 4 (d) ·75 (e) ·375

10. (a) $6\frac{41}{200}$ (b) $17\frac{6}{125}$ (c) $30\frac{27}{500}$ (d) $12\frac{69}{200}$

11. (a) ·07m (b) ·065km (c) ·125 l (d) ·108km (e) ·4Re

12. (a) 7·15m (b) 1·075kg (c) 1·2 l (d) Rs 3·08 (e) 347 km

## Exercise 2·13

1. (a) ·572 (b) 5·17 (c) 35·035 (d) 13·23

2. (a) 9·112 (b) 27·617 (c) 23·198 (d) 104·079

3. (a) 170·2078 (b) 206·378 (c) 579·2879 (e) 175·3207

4. 14·705m 5. 21·09cm 6. 572 lakh

7. (a) 5·16 (b) 7·07 (c) 8·48 (d) 75·16

8. (a) 9·16 (b) 6·48 (c) 16·023 (d) 41·092

9. (a) 207 (b) 3·375 (c) 90·236 (d) ·9592

10. Rs. 77·835 lakh

11. 634·75 hectare; 2282 hectare 12. 1·325 km.

13. (a) 8·3248 (b) 49·967 (c) 97·373 (d) 126·418

14. 770·2 kg 15. ·615.

## Exercise 2·14

1. (a) 56·2, 562, 5620

   (b) 70·41, 704·1, 7041

   (c) 270·284, 2702·84, 27028·4.

   (d) 5862·7, 58627, 586270

   (e) 4506·431, 45064·31, 450643·1

2. (a) 654·8 (b) 10205 (c) 42 (d) ·2 (e) 100·4 (f) ·47

3. (a) $10^1$ (b) $10^5$ (c) $10^3$ (d) $10^2$ (e) $10^4$ (f) $10^6$

4. 3048 cm 5. Rs. 65

6. (a) 43·27, 4·327, ·4327

   (b) 798·652, 79·8652, 7·98652

(c) 20·135, 2·0135, ·20135

(d) 6·205, ·6205, ·06205

(e) ·07, ·007, ·0007

7. (a) 10 (b) 100 (c) 100 (d) 100 (e) 1000.

8. (a) 72·45 (b) 9·0821 (c) 4·17641
(d) ·2769 (e) ·3254 (f) ·0062

9. 76·4 10. 1·25cm

## Exercise 2-15

1. (a) 59·2 (b) 323·16 (c) 913·6
(d) 179·795 (e) 339·48 (f) 112·8

2. 173880 (a) 17·388 (b) 1738·8
(c) 17·388 (d) 17·388 (e) 17·388

3. 696696 (a) 696·696 (b) 696·696
(c) 696·696 (d) 6·96696 (e) ·0696696

4. (a) 901·808 (b) 13136·68 (c) 3·984
(d) ·000512 (e) 12·288

5. (a) 7·2828 (b) ·014 (c) 2533·5501
(d) 154·34745 (e) 81·02976

6. 76·5kg 7. 63·5cm 8. Rs. 14·70

## Exercise 2-16

1. (a) 4·5 (b) 12·7 (c) 23·7 (d) 36·0 (e) 19·8

2. (a) 14·73 (b) 15·39 (c) 8·66 (d) 1·40 (e) 2·50

3. Rs. 4·74 (b) 8m 54cm (c) 6 l 589ml (d) 5kg 408g.

## Exercise 2-17

1 (a) 0·93 (b) 0·016 (c) 11·051 (d) 3·742

(e) 10·0205 (f) 3·071.

2. (a) 0·525 (b) 4·4125 (c) 2·205

(d) 0·2205 (e) 1·53125 (f) 0·5076

3. (a) 6·3 (b) 402·5 (c) 85 (d) 400

(e) 12·4 (f) 4·8

4. (a) 5·33 (b) 3·43 (c) ·06 d) ·07

(e) 111·11 (f) 136·36

5. (a) 0·528 (b) 1·512 (c) 5·602 (d) 280 (e) 13·27

6. 8·59 7. 1·875m 8 Rs. 40·35

9. 1·27cm 10. 1·301 kg

# 3. Elementary Number Theory

## 3-1 Odd and Even Numbers

### 3-1. 1 Divisors and Multiples :

Consider $20 = 4 \times 5$. 4 divides 20 without leaving any remainder. Here 4 is called the **divisor** of 20. 20 is **called** the **multiple** of 4. You have learnt these in your previous classes.

### Exercise 3-1

1. Write the divisors of each of the following :

   (a) 20 (b) 35 (c) 13 (d) 23

2. Write some of the multiples of each of the following.

   (a) 2 (b) 3 (c) 10

### 3-1. 2 Even numbers and odd numbers :

Numbers having 2 as one of its divisors are called **even numbers.**

(e.g.) 2 is the divisor of 14. Therefore 14 is an even number.

Whole numbers which leave 1 as remainder when divided by **2 are called odd numbers**. Thus, when 15 is divided by 2, it leaves 1 as remainder. Hence, 15 is an odd number.

3-1. 3 **Some properties of even numbers :**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (2) | 3 | (4) | 5 | (6) | 7 | (8) | 9 | (10) |
| 11 | (12) | 13 | (14) | 15 | (16) | 17 | (18) | 19 | (20) |
| 21 | (22) | 23 | (24) | 25 | (26) | 27 | (28) | 29 | (30) |
| 31 | (32) | 33 | (34) | 35 | (36) | 37 | (38) | 39 | (40) |
| 41 | (42) | 43 | (44) | 45 | (46) | 47 | (48) | 49 | (50) |
| 51 | (52) | 53 | (54) | 55 | (56) | 57 | (58) | 59 | (60) |
| 61 | (62) | 63 | (64) | 65 | (66) | 67 | (68) | 69 | (70) |
| 71 | (72) | 73 | (74) | 75 | (76) | 77 | (78) | 79 | (80) |
| 81 | (82) | 83 | (84) | 85 | (86) | 87 | (88) | 89 | (90) |
| 91 | (92) | 93 | (94) | 95 | (96) | 97 | (98) | 99 | (100) |

Fig 3-1

In the above figure the numbers which are circled are all even numbers.

You can discover the following properties from these.

(a) **The unit digit of an even number will be any one of 2,4,6,8,0.** This helps us to find whether a given number is even or odd.

On the other hand **if the unit digit of a number is anyone of 1,3,5,7,9 then it is odd number.**

*(b)* 10,20,30.........100.........are all even **numbers.**

***(i.e.)*** **10 and multiples of 10 are even numbers.**

14 and 16 are two consecutive even numbers. The difference between them is 2. **Hence the difference between any two consecutive even numbers is always 2.**

**Note :** To find the successor of a given even number we have to add 2 to that number. To find the predecessor of a given even number, we have to subtract 2 from that number.

**(d)** 17 and 19 are two consecutive odd numbers. The difference between them is also 2. **Hence the difference between any two consecutive odd numbers is always 2.**

**Note :** To find the successor of a given odd number, we have to add 2 to it. To find the predecessor of a given odd number we have to subtract 2 from that number.

*(e)* 8 and 20 are two even numbers. Their difference is 12. This is also even. **The difference between any two even numbers is also an even number.** Verify this considering some more even numbers.

*(f)* 7 and 21 are two odd numbers. **The difference between any two odd numbers is an even number.** Verify this considering some more odd numbers.

**(g)**

| + | 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| 2 | 4 | 6 | 8 | 10 | 12 |
| 4 | 6 | 8 | 10 | 12 | 14 |
| 6 | 8 | 10 | 12 | 14 | 16 |
| 8 | 10 | 12 | 14 | 16 | 18 |
| 10 | 12 | 14 | 16 | 18 | 20 |

A

| × | 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| 2 | 4 | 8 | 12 | 16 | 20 |
| 4 | 8 | 16 | 24 | 32 | 40 |
| 6 | 12 | 24 | 36 | 48 | 60 |
| 8 | 16 | 32 | 48 | 64 | 80 |
| 10 | 20 | 40 | 60 | 80 | 100 |

B

**Fig - 3-2**

From table A, we discover that **the sum of any two even numbers is an even number.**

From table B, we discover that **the product of any two even numbers is also an even number.**

From Table C, we discover that **the sum of any two odd numbers is an even number.**

From Table D, we discover that **the product of any two odd numbers is also an odd number.**

| + | 1 | 3 | 5 | 7 | 9 |
|---|---|---|---|---|---|
| 1 | 2 | 4 | 6 | 8 | 10 |
| 3 | 4 | 6 | 8 | 10 | 12 |
| 5 | 6 | 8 | 10 | 12 | 14 |
| 7 | 8 | 10 | 12 | 14 | 16 |
| 9 | 10 | 12 | 14 | 16 | 18 |

C

| × | 1 | 3 | 5 | 7 | 9 |
|---|---|---|---|---|---|
| 1 | 1 | 3 | 5 | 7 | 9 |
| 3 | 3 | 9 | 15 | 21 | 27 |
| 5 | 5 | 15 | 25 | 35 | 45 |
| 7 | 7 | 21 | 35 | 49 | 63 |
| 9 | 9 | 27 | 45 | 63 | 81 |

D

Fig-3-3

## Exercise 3-2

1. Pick out the even numbers and the odd numbers separately from the following numbers :

   (a) 35,748 (b) 73,851 (c) 7,014

   (d) 63,875 (e) 4,681 (f) 5,370

2. Is zero an odd number or an even number? State the reason

3. Which whole number has only one divisor?

4. Which whole number has all other whole numbers as its divisor?

5. Is the predecessor of an odd number, an odd number? Illustrate with example.

6. Is the predecessor of an even number, an even number? Illustrate with example.

7. Which of the following sums are even and which are odd? Find out without adding all the digits.

(i) 5738 + 7264 (ii) 8795 + 3480

(ii) 4362 + 5367 (iv) 1357 + 2465

8. Find whether the following are odd or even.

(a) odd number + odd number + odd number

(b) odd number + odd number + even number

(c) odd number + even number + odd number

(d) even number + odd number + odd number

(e) odd number + even number + even number

(f) even number + even number + odd number

(g) even number + odd number + even number

(h) even number + even number + even number

9. Find whether the following are even or odd :

(a) odd number × odd number × odd number

(b) odd number × odd number × even number

(c) odd number × even number × odd number

(d) even number × odd number × odd number

(e) odd number × even number × even number

(f) even number × even number × odd number

(g) even number × odd number × even number

(h) even number × even number × even number

**3-2. 1 Factors and divisors :**

You know that the divisors of 20 are 1, 2, 4, 5, 10 and 20 Here excepting 1 and 20 the rest are called the factors of 20. You know that 1 is the divisor of any number. So also any number excepting 0, is the divisor of itself. If a number has divisors other than 1 and the number itself those divisors are called the factors of that number.

From this we discover that all the factors of a number are also the divisors of it. But all the divisors of a number are not the factors of it.

**Note** : The number of divisors of a number is finite.

**3-2. 2 Prime numbers and composite numbers:**

24 pebbles can be arranged in a rectangular array as shown in the figures.

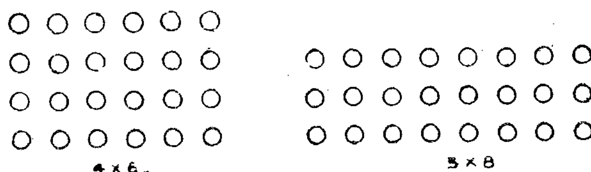



Fig. 3-4

Hence 24 can be written as $4 \times 6$ or $3 \times 8$. We can arrange 7 pebbles as shown in the following figure.

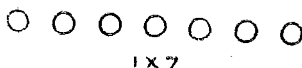



Fig. 3-5

Hence, 7 can be expressed as $1 \times 7$. 7 pebbles cannot be arranged in a rectangular array into more than one row.

**Practical :**

1. Arrange 12 pebbles in a rectangular array.
2. Express 12 as the product of two different numbers
3. Arrange 20 pebbles in a rectangular array.
4. Express 20 as the product of two different numbers
5. Arrange 21 pebbles in a rectangular array.
6. Express 21 as the product of two different numbers.
7. Try to arrange 5 pebbles in a rectangular array.
8. Can 5 be expressed as the product of two other numbers.
9. Try to arrange 11 pebbles in a rectangular array.
10. Can 11 be expressed as the product of two other numbers.

Natural numbers having **only two divisors** are called **prime numbers.**

Natural numbers having **more than two divisors** are called **composite numbers.**

(e.g.) 1. The divisors of 13 are 1 and 13.
The divisors of 17 are 1 and 17.

Therefore 13 and 17 are prime numbers.

2. The divisors of 15 are 1, 3, 5 and 15.
The divisors of 21 are 1, 3, 7 and 21.
The divisors of 24 are 1, 2, 3, 4, 6, 8, 12 and 24.

Therefore 15, 21 and 24 are composite numbers.

The number 1 has only one divisor. So, it is neither composite nor prime.

**3-2. 3 Method of finding the prime numbers:**

Eratosthenes (276—194 B.C.) a Greek Mathematician suggested a simple method for finding the prime numbers less than 101 It is known as 'the sieve of Eratosthenes'

Let us learn the method of finding out the prime numbers from 1 to 100.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

Fig. 3-6

In the above table 1, is not a prime number; cross it.

The next number is 2. 2 is prime; round it.

Cross all the multiples of 2, leaving the number 2.

The next number after 2 is 3. 3 is prime; round it. Cross out all the multiples of 3, leaving 3.

The next number is 4. It has already been crossed out as it is a multiple of 2. . Since all multiples of 4 are multiples of 2, we find all the multiples of 4 have also been crossed out.

The next number is 5. It is a prime; round it. Leaving 5, cross out all the multiples of 5. Some of them like 10,15,20 might have been crossed out already.

The next number is 6. This is a multiple of 2 and 3. So, it has already been crossed out. Further all the multiples of 6 have also been crossed out.

The next number is 7. It is prime; round it. leaving 7, cross out all the multiples of 7.

8,9,10 have already been crossed out. (why?) If we proceed in the same manner the numbers found in the following tables will be without cross. All the other numbers will remain crossed.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| — | 2 | 3 | — | 5 | — | 7 | — | — | — |
| 11 | — | 13 | — | — | — | 17 | — | 19 | — |
| — | — | 23 | — | — | — | — | — | 29 | — |
| 31 | — | — | — | — | — | 37 | — | — | — |
| 41 | — | 43 | — | — | — | 47 | — | — | — |
| — | — | 53 | — | — | — | — | — | 59 | — |
| 61 | — | — | — | — | — | 67 | — | — | — |
| 71 | — | 73 | — | — | — | — | — | 79 | — |
| — | — | 83 | — | — | — | — | — | 89 | — |
| — | — | — | — | — | — | 97 | — | — | — |

Fig. 3-7

If we look at these numbers carefully we can discover the following:

(1) Except 2, all the even numbers are not primes.

(2) Except 5, no other prime number ends in 5.

(3) The pairs (3, 5), (5, 7), (11, 13), . . . . have a difference of 2. A pair of prime numbers with a difference of 2 are all called 'Twin Primes'

**3-2. 4 Co-primes:**

Two natural numbers are called co-primes, if they have no common factor other than 1.

**Example:**

The common divisor of 9 and 25 is 1.

∴ They are co-primes.

(7, 17), (7, 15), (16, 21) are other examples for co-primes.

**3-2. 5 Prime Factorization:**

36 can be written as $3 \times 12$. Here 3 is prime and 12 is composite.

12 can be written as $3 \times 4$. Here 3 is prime and 4 is composite.

4 can be expressed as $2 \times 2$. Here 2 is prime.
Hence $36 = 3 \times 3 \times 2 \times 2 = 3^2 \times 2^2$

The process of expressing a given whole number as the product of two or more prime numbers is called prime factorization.

**Exercise 3-3**

1. Give a counter example to show that each of the following statements is false.

(a) odd numbers are always primes.

(b) All the primes are odd numbers.

(c) The sum of any two primes is a composite number.

2. Give an example for the following statements :

(a) The sum of two composite numbers may be a prime.

(b) The difference between two composite numbers may be a prime.

3. Express the following as product of prime factors.

(a) 144 (b) 208 (c) 72 (d) 135

4. Give three examples for prime twins :

5. Verify whether the following pairs are co-primes.

(a) 12,17 (b) 8,27 (c) 28,42 (d) 19,23

(e) 27,36 (f) 35,57.

6. Write all the primes between 20 and 30.

7. Write any two composite numbers which end in 7.

8. Express the following as the sum of two prime numbers.

(a) 18 (b) 26 (c) 32

9. A number and its successor are primes. What are they?

## 3-3. Greatest common Divisor and least common multiple :

### 3-3. 1. Common divisors, Greatest common divisor.

The divisors of 12 are 1,2,3,4,6 and 12.

The divisors of 18 are 1,2,3,6,9 and 18.

1,2,3 and 6 are divisors of both 12 and 18. They are, called common divisors.

6 is the greatest of the four common divisors.

∴ **The g.c.d. of 12 and 18 is 6.**

We can also find the g.c.d. in the following method.

$12 = 2 \times 2 \times 3$

$18 = 2 \times 3 \times 3$

$$\begin{array}{r|l} 2 & 12 \\ \hline 2 & 6 \\ \hline & 3 \end{array} \qquad \begin{array}{r|l} 2 & 18 \\ \hline 3 & 9 \\ \hline & 3 \end{array}$$

The g.c.d. of 12 and 18 is $2 \times 3 = 6$

**3-3. 2. Common multiple and least common multiple :**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

**Fig 3-8**

In the above figure the multiples of 3 are rounded. The multiples of 4 are shown within the square frame. From this, you can discover that the common multiples of 3 and 4 are 12,24,36,... ..... ...... The least among them is 12 and is called the least common multiple (l.c.m.)

We can find the l.c.m. of 2 numbers using the following method.

**(a) When two numbers are co-primes :**

3 and 4 are co-primes. We have found that the l.c.m. of these 2 numbers is 12. Hence, if any two numbers are co-primes, their product is the l.c.m.

**(b) When the two numbers are not co-primes :**

6 and 8 are not co-primes, for 2 is a common factor

The multiples of 6 are 6,12,18,24,30,36,42,48 . . . .

The multiples of 8 are 8,16,24,32,40,48 . . . .

The common multiples of 6 and 8 are 24,48 . . . .

∴ their l.c.m. is 24.

**Note :** The multiples of a number are infinite.

The l.c.m. can also be found by the following method :

$$6 = 2 \times 3$$

$$8 = 2 \times 2 \times 2$$

The l.c.m. is $2 \times 3 \times 2 \times 2 = 24$

So, if two numbers are not co-primes, find the factors of each of them. Find the common factors and mark them. The l.c.m. is the product of the common factors and the other factors.

Let us find the relation between the g.c.d. and the l.c.m.

You know the g.c.d. of 6 and 8 is 2. The l.c.m. of 6 and 8 is 24.

The product of the two numbers $= 6 \times 8 = 48$.

The product of the g.c.d. and the l.c.m $= 2 \times 24 = 48$.

From this example. we find that the product of the l. c. m. and the g.c.d. of two given numbers is equal to the product of the given numbers. Therefore, l.c.m. $= \frac{\textbf{Product of the numbers}}{\textbf{g. c. d.}}$

**Exercise 3-4**

1. Find the g.c.d. of the following:

   (a) 24, 30, (b) 25, 45 (c) 12, 48 (d) 48, 32

   (e) 9, 25 (f) 18, 54 (g) $2 \times 2 \times 3$, $2 \times 2 \times 5$

   (h) $3 \times 5 \times 7$, $3 \times 7 \times 11$ (i) $2 \times 2 \times 3 \times 3 \times 3$, $2 \times 2 \times 2 \times 3 \times 3$

2. Find the l.c.m. of the following:

   (a) 12,16 (b) 18,24 (c) 30,45 (d) 20,100

   (e) 25,35 (f) 9,25 (g) 14,15

   (h) $2 \times 3 \times 3$, $2 \times 5 \times 7$ (i) $2 \times 2 \times 3 \times 3$, $2 \times 3 \times 5$

3. The g.c.d. of two numbers is 6. Their l.c.m. is 90. If one of them is 30, find the other number.

4. Given two numbers 182 and 455, and their g.c.d. 91 find the l.c.m.

5. If a,b are co-primes find their l.c.m. and g.c.d.

**3-4. Criteria of Divisibility:**

Let us recall what you have learnt about divisibility by a few numbers.

**Divisibility by 10 :**

**A natural number will have 10 as a factor if and only if its last digit (i.e. unit digit) is zero.**

(e.g.) 540 is divisible by 10 where as 54 is not divisible by 10.

**Divisibility by 5 :**

10 is divisible by 5. Hence if the unit digit is zero, the number is divisible by 5.

Further if the unit digit is divisible by 5 the number will be divisible by 5.

Hence **a natural number is divisible by 5 if and only if its last digit is 5 or zero.**

**Divisibility by 4 :**

Some of the multiples of 10 are not divisible by 4. For example, 30,50 are not divisible by 4. But 100 and multiples of 100 are divisible by 4.

Hence **a natural number is divisible by 4 if the last two digits are zeros or the number formed by the last two digits is divisible by 4.**

**Divisibility by 8 :**

Some of the multiples of 100 are not divisible by 8. But 1000 and multiples of 1000 **are divisible** by 8.

Hence **a natural number is divisible by 8 if the last 3 digits are zeros or the number formed by the last three digits is divisible by 8**

**Divisibility by 3 :**

### Exercise 3-5

(1) 876 (a) Is this divisible by 3 ?
(b) What is the sum of the digits ?
(c) Is the sum of the digits divisible by 3 ?

(2) 458 (a) Is this divisible by 3 ?
(b) What is the sum of the digits ?
(c) Is the sum of the digits divisible by 3 ?

(3) Find answers to the above questions w.r.t. the following numbers.

(a) 5871 (b) 3682 (c) 2469
(d) 4693 (e) 1945 (f) 5370
(g) 3827 (h) 7941 (i) 8062

(4) What do you learn from this?

You can find out that **a natural number is divisible by 3 if and only if the number got by summing up the digits is divisible by 3.**

**Divisibilitity by 9 :**

### Exercise 3-6

(1) 369 (a) Is this divisible by 9?
(b) What is the sum of the digits?
(c) Is the sum of the digits divisible by 9 ?

(2) 745 (a) Is this divisible by 9?
(b) What is the sum of the digits?
(c) Is the sum of the digits divisible by 9 ?

(3) Find answers to the above questions w.r.t. the following numbers :

(a) 5781 (b) 3915 (c) 4073

(d) 4563 (e) 2480 (f) 7254

(g) 2781 (h) 1943 (i) 7621

4. What do you learn from this?

You can find out that **a natural number is divisible by 9 if and only if the number got by summing up the digits is divisible by 9.**

**Divisibility by 6 :**

**Exercise 3-7**

1. 428 (a) Is this divisible by 3?
   (b) Is this divisible by 2?
   (c) Is this divisible by 6?

2. 546 (a) Is this divisible by 3?
   (b) Is this divisible by 2?
   (c) Is this divisible by 6?

3. 725 (a) Is this divisible by 3?
   (b) Is this divisible by 2?
   (c) Is this divisible by 6?

4. Find answers to the above questions. w.r.t. the following numbers.

   (a) 795 (b) 486 (c) 571 (d) 641 (e) 468

   (f) 970 (g) 6125 (h) 1274 (i) 3846

5. What do you infer from this?

You can find out that **a natural number is divisible by 6 if and only if it is divisible by 2 and 3.**

In short its last digit must be 0,2,4,6,8, and the sum of the digits must be divisible by 3.

**Divisibility by 11 :**

**Exercise 3-8**

1. 4719 (a) Is this divisible by 11?
   (b) Find the sum of the alternate digits separately.
   (c) Find their difference.
   (d) Is the difference divisible by 11?

2. 59482 (a) Is this divisible by 11?
   (b) Find the sum of the alternate digits separately.
   (c) Find their difference.
   (d) Is the difference divisible by 11?

3. Find answers to the above questions w.r.t. the following numbers.

   (a) 38590 (d) 92807 (g) 47632
   (b) 61924 (e) 90717 (h) 97356
   (c) 81917 (f) 37642 (i) 17831

4. What do you learn from this ?

   You can find out that a **natural number is divisible by 11 if and only if the defferenc of the greater and the smaller of the numbers got on adding the alternate digits separately is divisible by 11. The difference may also be equal to zero**

**Exercise 3-9**

1. Verify whether the following numbers are divisible by 2,3,4,5, 6,8,9,10 and 11.
   (a) 7385 (b) 14528 (c) 369082
   (d) 24683 (e) 135792 (f) 147026

2. Find the appropriate missing numbers.
   (a) 58 * 47 — Divisible by 3.
   (b) 1 * 3046 — " " 11
   (c) 4983 — " " 11

| | | | | | |
|---|---|---|---|---|---|
| (d) | 6482* | — | Divisible | by | 3 |
| (e) | 1357*6 | — | „ | „ | 4 |
| (f) | 753*4 | — | „ | „ | 4 |
| (g) | 25817* | — | „ | „ | 6 |
| (h) | 42175* | — | „ | „ | 6 |
| (i) | 2468* | — | „ | „ | 9 |
| (j) | 84*29 | — | „ | „ | 9 |

3. Give two examples for each of following :

   (a) A number will be divisible by 2 if it is divisible by 4.

   (b) A number will be divisible by 4 if it is divisible by 8.

   (c) A number will be divisible by 3 if it is divisible by 9.

   (d) A number will be divisible by 5 if it is divisible by 10.

4. Prove the following statements to be false by giving suitable counter examples.

   (a) A number will be divisible by 4 if it is divisible by 2.

   (b) A number will be divisible by 8 if it is divisible by 4.

   (c) A number will be divisible by 9 if it is divisible by 3.

   (d) A number will be divisible by 10 if it is divisible by 5.

   (e) A number will be divisible by 8 if it is divisible by 2 and 4.

# ANSWERS

## Exercise 3-1

1. (a) 1,2,4,5,10,20. (b) 1,5,7,35 (c) 1,13 (d) 1,23.

2. (a) 2,4,6,8,10,. . (b) 3,6,9,12,15,. .
   (c) 10,20,30,40,. .

## Exercise 3-2

1. (a) even (b) odd (c) even (d) odd (e) odd (f) even.

2. even 0 fits in the following pattern.
   10,8,6,4,2,0.

3. 1 4· 0 (excepting 0).

5. even; predecessor of 9 is 8 (even). 6. odd: successor of 10 is 11 (odd). 7. (i) even (ii) odd (iii) odd (iv) even

8. (a) odd (b) even (c) even (d) even (e) odd
   (f) odd (g) odd (h) even

9. (a) odd (b) even (c) even (d) even (e) even
   (f) even (g) even (h) even.

## Exercise 3-3

1. (a) 9 is an odd number but it is not prime.
   (b) 2 is an even number but 2 is a prime.
   (c) $2+3=5$, a prime number.

2. (a) $4+9=13$; a prime. (b) $25-22=3$, a prime

3. $144=2^4\times3^2$; $208=2^4\times13$; $72=2^3\times3^2$; $135=3^3\times5$

4. (29,31), (41,43), (59,61).

5. (a) Relatively prime. (b) Relatively prime.
(c) Not relatively prime. (d) Relatvely prime.
(e) Not relatively prime. (f) Not relatively prime.

6. 23,29 7. 27,57 8. (a) $7+11$ (b) $7+19$
(c) $1+31$ 9. 2,3.

## Exercise 3-4

1. (a) 6 (b) 5 (c) 12 (d) 16 (e) 1 (f) 18
(g) $2\times2$ (h) $3\times7$ (i) $2\times2\times3\times3$.

2. (a) 48 · (b) 72 (c) 90 (d) 100 (e) 175 (f) 225
(g) 210 (h) $2\times3\times3\times5\times7$ (i) $2\times2\times3\times3\times5$.

3. 18 4. 910 5. g.c.d. 1; l.c.m. $a\times b$

## Exercise 3-9

1. (a) 5 (b) 2,4,8 (c) 2 (d) Not divisible by any of the given numbers (e) 2,3,4,6,8,9 (f) 2,11.

2. (a) 0,3,6,9 (b) 2 (c) 5 (d) 1,4,7 (e) 1,3,5,7,9
(f) 0,2,4,6,8 (g) 4 (h) 2,8 (i) 7 (j) 2

4. (a) 10 (b) 12 (c) 6 (d) 15 (e) 12

# 4. Measures and Measurements

**4-1. Measurement of Time:**

We tell time by looking at the face of a clock. But in olden days, during day time people used to tell time by the position of the sun or shadows and during nights by looking at the stars. Usually the duration between two consecutive midnights is considered as a **day**.

You would have learnt in your geography classes that

1. One day is the time taken by the earth to make one complete rotation about its axis, and

2. A year is the time taken by the earth to make one complete revolution about the sun.

The other measures of time are seconds, minutes, hours, weeks, months and years.

The present method of measurement of time is as follows:

| | | |
|---|---|---|
| 60 seconds | = | 1 minute |
| 60 minutes | = | 1 hour |
| 24 hours | = | 1 day |
| 7 days | = | 1 week |
| 30 days | = | 1 month |
| 12 months | = | 1 year |
| 52 weeks | = | 1 year |
| 365 days | = | 1 common year |
| 366 days | = | 1 leap year |

All the twelve months do not have equal number of days. Some months have 31 days, some have 30 days and the month of February has 28 days. These put together make up 365 days. But a year is a little more than 365 days and is less than 365¼ days. A year is roughly equal to 365. 2422 days.

Considering that a year has 365¼ days, we add a day to the month of February for every fourth year. This year is called a **leap year.** If the number of a year, in Christian Era, is divisible by 4, it is considered a leap year. But when the year ends in 00, years divisible by 400 alone are considered as leap years. This system reduces the error in taking the number of days in a year as 365.25 days.

In our country, in ancient days the period from the time of one sunrise to the next sunrise was considered as a day. According to this system, the day is divided into 60 nazhigais and each nazhigai is divided into 60 vinadis. In this system, one hour is made up of 2½ nazhigais and each nazhigai is made up of 24 minutes.

Ancient method of measurement of time is given below :

| | | |
|---|---|---|
| 60 vinadis | = | 1 nazhigai |
| 60 nazhigai | = | 1 day |
| 1 nazhigai | = | 24minutes |

**Note** : As the sun rise differ day after day, this system is not widely used. But even today, this system is used in our country in denoting the Muhurtham time in marriages and the birth time of a child.

(e g.) If we say "after 6 nazhigais" it means after $6 \times 24 = 144$ minutes. This in time means 2 hours 24 minutes after sunrise.

You know that the time between one midnight and the next midnight is considered as a day. Similarly, the time from the midnight to the next noon is considered as **fore noon** (F. N )

The time from the noon to the next midnight is considered as after noon (A. N.).

But in Railway time-tables, the period of 24 hours from one midnight to the next midnight is considered as a day. That is, while 4-15 A.M. is noted as 4-15 hours, for example 4-15 P.M. is noted as 16-15 hours in those tables. 4-15 hours is also written as 04-15 hours.

Besides these system of measuring time, the Government of India has evolved **The National Calendar.** Every morning the A.I.R. announces the time as per this calendar. This system is known as **Saka Era**. Every year is called as **Saka Year.**

The fiirst day of the year in this system is the day on which the sun crosses the equator northwards, which in the Christian Era, is the 22nd of March.

The difference between the Saka Era and the Christian Era is 78 years.

We can get the Saka Year by subtracting 78 from the Christian Era.

The table below gives you the relation between the two eras.

| Saka month | Number of days | First day of the month in English Calendar |
|---|---|---|
| Chaitra | — 30 or 31 — | March 22 or 21 |
| Vaisaka | — 31 — | April-21 |
| Jyeshta | — 31 — | May -22 |
| Ashada | — 31 — | June -22 |
| Shravana | — .31 — | July -22 |

| | | | | |
|---|---|---|---|---|
| Bhadra | — | 31 | — | Aug -23 |
| Asvina | — | 30 | — | Sep -23 |
| Karthika | — | 30 | — | Oct -23 |
| Agrahayana | — | 30 | — | Nov -22 |
| Pousha | — | 30 | — | Dec -22 |
| Magha | — | 30 | — | Jan 21 |
| Phalguna | — | 30 | — | Feb -20 |

Just as February consists of 29 days in a leap year, the month chaitra consists of 31 days in a leap year.

Note : Add 78 to the number indicating the Saka Year. If this sum is divisible by 4, the Saka Year is a leap year in Saka Era.

### Exercise 4-1

1. (a) How many seconds are there in an hour?
   (b) How many minutes are there in a day?
   (c) How many hours are there in a week?
   (d) How many nazhigais are there in a day?
   How many vinadis are there in a day?

2. (a) Which of the following are leap years?
   (a) 1956 A.D. (b) 1880 A.D. (c) 2000 A.D. (d) 1900 A.D.

3. State the corresponding Saka Year.
   (a) 1956 A.D. (b) 1900 A.D. (c) 1928 A.D. (d) 1979 A.D.

4. State the corresponding year in Christian Era.
   (a) Saka 1900 (b) Saka 1928 (c) Saka 1879 (d) Saka 1950

5. Express the following in railway time.

   (a) 7-30 A.M. (b) 12-50 P M. (c) 7-25 P.M.

   (d) 12 midnight (e) 3-10 P.M.

6. Express the following railway times in the usual ordinary system, stating A.M. or P.M., whichever is applicable.

   (a) 14-20 (b) 16-28 (c) 4-52 (d) 13-55 (e) 11-18

7. A marriage is to be celebrated after $7\frac{1}{2}$ nazhigai and before 10 nazhigai after sunrise. When does the Muhurtham time begin and when does it end?

8. The sun rises at 6 hours 15 minutes on a day. Express the following in 'nazhigai' after sunrise on that day.

   (a) 8-45 hours A.M. (b) 9-45 hours A.M.

   (c) 2-15 hours P.M.

9. One day the sun rose at 5-52 in the morning and set at 6-18 in the evening. Find the duration of the day. Find also the duration of the night.

10. The dates of births of Mani, Murugan and their sister Selvi are 21—8—1951, 25—9—1954, and 19—5—1959 respectively. Find their ages as on 1—7—1980.

11. George was born 15 years 6 months 18 days ago and his father was born 40 years 2 months ago. Find the difference in their ages.

12. A school functions from 9 A.M. till 2-15 P.M. and from 1-15 P.M. till 4-10 P.M. The school works 6 days a week. Calculate the total working hours in a week.

13. One day, the lunar eclipse began at 10-20 P.M. and ended at 12-10 A.M. Find the duration of the eclipse.

14. A labourer begins his work at 3-45 P.M He works till 11-45 P.M There is an interval from 7-45 P.M. to 8-15 P.M. How long has he worked?

15. A clock loses 15 seconds in an hour. It was set at 6 A.M. Find the correct time when it shows 6 P.M. on the same day.

16. The time-table of trains departing from Madras Egmore and arriving at Tiruchirappalli is given below :

| Name of the train | Time of departure | Time of arrival |
|---|---|---|
| Cholan Express | 09—50 | 19—30 |
| Ganga-Kaveri Express | 20—15 | 06—05 |
| Tuticorin Express | 15—20 | 02—40 |

(a) Find the time taken by each train to reach Tiruchirappalli.

(b) Which is the fastest train?

(c) Which is the slowest train?

17. The time-table of a train departing from Coimbatore and arriving at Jolarpet is given below :

| Railway Station | Time of arrival | Time of departure |
|---|---|---|
| Coimbatore | — | 21—00 |
| Tirupur | 21—51 | 21—54 |
| Erode | 22—45 | 23—15 |
| Salem | 00—15 | 00—20 |
| Jolarpet | 02—25 | — |

(a) Find the total time taken by this train to reach Jolarpet from Coimbatore.

(b) If the distance between Coimbatore and Jolarpet is 280 km. find the average speed of the train.

(c) Find the total time of halt in between.

(d) Find the total running time.

**Example:** Calculate the number of days from 4—6—1979 to 21—9—79.

| Months — | Days |
|---|---|
| June (30-3) | 27 |
| July | 31 |
| August | 31 |
| September | 20 |
| Total | 109 |

∴ Total number of days 109.

**Note:** For 'from' include that day and for 'to' exclude that day.

**Example:** 12—3—1979 was Monday. What day will 15—12 - 1979 be?

First calculate the number of days from 12—3—1979 to 15—12—1979.

| Months — | Days |
|---|---|
| March (31-11) | 20 |
| April | 30 |
| May | 31 |

7 | 278 days
39 weeks 5days

| | | |
|---|---|---|
| June | 30 | |
| July | 31 | |
| August | 31 | |
| September | 30 | |
| October | 31 | |
| November | 30 | |
| December | 14 | |
| Total | 278 | days |

278 days = 39 weeks 5 days.

From Monday 12th March after 39 weeks we will again get Monday; 5 days after that will be Saturday. Hence 15—12—1979 will be Saturday.

## Exercise 4·2

1. A man took medical leave from 10—2—1978 to 24-5-1978. For how many days did he go on leave?

2. Calculate the number of days in each of the following :

   (a) March 28th to June 18 of the same year.

   (b) January 13th to April 20th of 1976.

   (c) October 25th of a year to January 12th (inclusive) of the next year.

   (d) 21—6—1978 to 12—2—1979 (inclusive)

3. Find the day in each of the following :

(a) May 6th, 1979 was Sunday. What will be the day on October 30th of the same year.

(b) November 8th, 1979 was Thursday. Calculate the day on February 6th, 1980.

4. A contractor agreed to complete a building in 150 days and started the work on 10–2–'79. But he finished his work only on 15–8–'79. How many more days had he taken?

5. An express train takes 8 hours 24 minutes to travel from one place to another place. A passenger train takes 11 hours 8 minutes. Find the difference between the time taken.

6. A machine worked for 30 days. It worked for 12 days at 6 hours 30 minutes per day and for the remaining days at 5 hours 40 minutes per day. Find the total number of hours it worked.

7. A train departs from Madras at 22–30 and reaches Trichy at 6–45 next day. It has halted for 24 minutes in between. Find the total running time.

8. Estimate the time taken by you to reach the school from your house, your play time, etc. Verify your estimates by actually using the clock.

Practise to estimate the small duration of time.

## 4-2. Measures :

Many nations have adopted Metric Measures. Our Nation also has adopted this system The simple reason for using this system is that it is very easy to calculate Our monetary system, linear measures measures of mass and measures of capacity are all in the metric system

You have learnt about these measurement in your previous classes

Though there are many measures in this system, only a few measures are mostly used

For example,

**In linear measures:** centimetre, metre and kilometre,

**In measures of capacity:** milli litre, litre and kilo litre; and

**In measures of mass.** gramme, kilogramme, quintal and metric tonne are commonly used.

Generally, we buy groceries in grammes or kilogrammes whereas the wholesale merchants buy them in larger denominations **Quintal** and **tonne** are used by the latter

100 kilogrammes = 1 quintal

10 quintals = 1 metric tonne.

Remember the following table :

| | |
|---|---|
| 100 paise = 1 Rupee | 1,000 grammes = 1 kilo gramme |
| 100 centimetre = 1 metre<br>1,000 metre = 1 kilometre | 1,000 kilogrammes = 1 quintal<br>10 quintals = 1 **tonne.** |
| 1,000 milli litre = 1 litre<br>1,000 litres = 1 kilolitre | |

**4-2 1 Linear Measures :**

(e.g.) Express 4 kilo metres 5 hectometres 6 decametres 8 metres in metres

4km. 5hm 6decam. 8m $= 4 \times 1000m + 5 \times 100m + 6 \times 10m + 8m$

$= 4000 + 500 + 60 + 8m$

$= 4{,}568$ m

*(e.g.)* **Express 7,256 millimetres in higher denomination.**

$$7{,}256 \text{ mm.} = \frac{7256}{1000} \text{ m.} = 7{,}256\text{m}$$

Usually we express the speed of a train or a car as so many kilometres per hour. (km/ph).

1km = 1,000 m; 1 hour = 3,600 seconds.

Therefore the speed of one kilometre per hour is the same as $\frac{1000}{3600}$ metres per second or $\frac{5}{18}$ m/sec.

Similarly a speed of 1 metre per second is the same as $\frac{18}{5}$ km/hour.

### Exercise 4-3

1. Express in metres;

   (a) 3,945 mm. (b) 2,115cm. (c) 3,005mm.

   (d) 8,014mm.

2. Express in kilometres.

   (a) 4,516m. (b) 25,316m. (c) 8,000m. (d) 5,008m.

3. **Find the speed in metres per second.**

   **(a) 18km/hours (b) 27km/hours (c) 36km/hours**

   **(d) 9 km/hours.**

4. **Find the speed in kilometres per hour.**

   **(a) 10m/sec (b) 25m/sec (c) 40m/sec (d) 125m/sec.**

5. The measures of the four sides of a field are 28m 75 cm; 31m 50 cm; 29m 25 cm and 27m 40 cm respectively. If a man goes round the field twice, find the distance covered him by.

6. A wheel covers 90 cms in one revolution. It makes 100 revolutions per second. Find its speed in kilometres per hour.

7. The length of a wire is 2 decam. 3 decim. How many pieces can be cut off from this if the length of one piece is 70 cms?

8. The length of a coil of barbed wire is 100 m. If a piece of wire of length 28 m, 5 decim, 6 cms is cut off, what is the length of the remaining wire?

9. To stitch a shirt 2 m 40 cm cloth and to stitch a pair of trousers 1 m 20 cm cloth are required. What is the total length of cloth required to stitch 8 shirts and 6 pairs of trousers.

10. A wheel of a cart covers 1 m 60 cms in one revolution. How many revolutions will it make while travelling 2 km 8 decametres.

**4-2 2. Measures of Capacity.**

(e.g.) 1. Express 4 litres 500 millilitres in millilitres.

4 litres 500 millilitres = 4000ml + 500ml. = 4500ml.

(e.g.) 2. Express 4,276 ml in kilolitres.

$$4276—l = \frac{4276}{1000} kl = 4{\cdot}276 \text{ kl}$$

**Exercise 4—4**

1 Express in litres: (a) 4,285 ml (b) 5,000 ml (c) 7,550 ml (d) 3,600 ml.

2. Express in kilo litres : (a) 2,008 l (b) 3,124 l (c) 4,036 l (d) 3,160 l

3. Express in milli litres :

   (a) 5 l 467 ml (b) 3 l 75 ml (c) 4 l 105 ml
   (d) 6 l 50 ml

4. Express in litres :

   (a) 4 kl 72 l (b) 10 kl 47 l (c) 5 kl 107 l (d) 10 kl 45 l

5. Four milk vendors supply the following quantities of milk to a hotel :

   25 l 500 ml , 30 l 250 ml ; 15 l 500 ml ; 40 l 750 ml.
   What is the total quantity of milk supplied by them ? If the milk costs Rs. 1-80 per litre, find the total cost.

6. A tin contains 12 l 125 ml oil. Another tin contains 1 l 500ml less than the first. Find the total quantity of oil in the two tins.

7. The capacity of a water tank is 24 kl 5 hl 6 deca l 5 litres. There is 15 kl 7 hl 3 deca l 8 l of water in it. How much water is to be poured to fill the tank?

8. There is 10 kl 20 hl 5 l of kerosene in a Petrol Bunk. This kerosene is distributed at the rate of 250 l per cart. How many carts can be filled up with that kerosene?

## 4 - 2 3. Measures of Mass

(e. g.) Express 5 Kilogrammes 100 grammes in grammes.

5 kg 100 gm = 5 × 1000 gm + 100 gm

= 5000 + 100 gm

5,100 gm.

(e.g.) Express 1 metric tonne 8 quintal 70 kg in kilogrammes

1 metric tonne 8 quintal 70kg

$= 1 \times 1000 \text{ kg} + 800 + 70 \text{ kg}$

$= 1000 + 800 + 70 \text{ kg}$

$= 1{,}870 \text{ kg.}$

(e.g.) Express 5,216 grammes in kilogrammes.

$$5{,}216 \text{ g.} = \frac{5216}{1000}\text{kg} = 5{\cdot}216 \text{ kg}$$

(e.g.) Express 3,208 kg in its higher denomination.

$$3{\cdot}208 \text{ kg} = \frac{3{\cdot}208}{100}\text{quintal} = 32{\cdot}08 \text{ quintals}$$

$$32{\cdot}082 = \frac{32{\cdot}08}{10}\text{tonne} = 3{\cdot}208 \text{ tonne}$$

## Exercise 4-5

1. Express in kilogrammes :
   (a) 3,105 gm (b) 4,000gm (c) 2,550 gm (d) 2,746 gm
2. Express in metric tonnes :
   (a) 4,070 kg (b) 3,000 kg (c) 384 q (d) 3,075 kg
3. Express in quintals :
   (a) 875 kg (b) 2,018 kg (c) 1,698 kg (d) 989 kg
4. Express in grammes :
   (a) 2kg 543g (b) 7kg 16g (c) 5kg 204g (d) 3kg 258g
5. Express in kilogrammes.
   (a) 1 tonne 6 quintal 80 kilo grammes
   (b) 4 tonne 7 quintal

(c) 3 tonne 47 kg

(d) 6 tonnes 9 quintals 16 kg

6. The quantity of chillies sold out on 4 days in a chilly mundy are as follows: 4 quintal 6kg 500g; 5 quintal 8 kg; 4 quintal 75kg; 2quintal 90 kg. Find the total quantity of chillies sold.

7. A ceitain quantity of Tamarind with seeds weighs 4 quintal 5 kg. When the seeds are removed, it weighs 2 quintal 6 kg 500gm. What is the weight of the seeds?

8. A vessel containing oil weighs 3kg 125 gms. The weight of the oil alone is 2kg 400gms. Find the weight of the empty vessel.

9. A bag of sugar weighs 92kg 500 gm. What is the weight of 16 such bags of sugar?

10. 23 tonnes 240 kg of rice is packed in 280 bags. What is the weight of each such bag?

**4·3. Square Measure:**

4-3 1. In a plane, the measure of the region of a closed plane curve is called **Area.** We require units to find area. The area of a square region is expressed in square units.

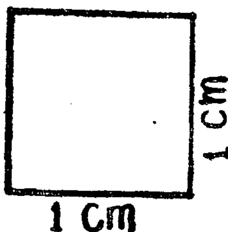



Fig. 4-1

Consider the figure of the square given.

Each of its four sides measures 1 cm.

The area of the square is 1 square centimetre. It is the standard unit of area.

Sq. cm. is used as the unit to measure the area of small things.

For finding the area of class rooms, school garden, houses etc. we use square metre as the unit. The area of the square region of a square each of its side measuring 1 metre is called the square metre.

1 metre = 100 cms.

1 sq. metre = $100 \times 100$ sq. cm. = 10,000 sq. cm.

Areas of big gardens, fields are expressed in Ares and Hectores. A hectare is equal to one square hectometre and 100 ares make one hectare.

1 Square hectometre = 1 dam × 1 dam.

= $10 \times 10 = 100$ sq. **dam**

1 Are = 1 sq. dam.

1 Are = 100 sq. m.

1 Hectare = 100 sq. dam.

or 100 Ares

or 10,000 Sq. m

**Remember the following conversion Table .**

1 sq. deci m = 100 sq. cm

1 sq metre = 100 sq. deci m

= 10,000 sq. cm

1 Hectare = 1 sq hectometre

= 100 sq. deca metre.

= 10.000 sq m.

1 sq. km = 100 sq. h m

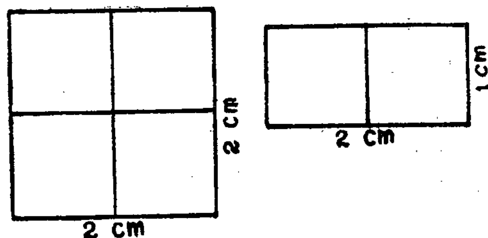
**Note** : 1 sq cm = 0.01 sq deci metre

= 0.0001 sq.m.

Similarly, 1 sq. metre = 0.01 Are

= 0.0001 Hectare

**Important note** : A square of 2 cm and 2 sq. cm are entirely different. A square of 2 cm means a square whose side measures 2cm. The area of that square region is $2 \times 2$ sq.cm. = 4 sq.cm.




2 cm. cm. Squares, 2sq. cm

Fig. 4-2

2 sq cm means two squares each of them having 1cm as its side

Hence they are entirely different.

**4-3. 2.**

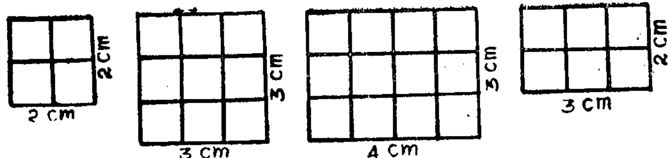



Fig. 4-3

Consider the above illustrations :

**Fig (i) :** It is a square. The measures of its four sides are equal. Each side measures 2cm. In this square region we can fix up four 1 cm squares. Therefore the area of this region is $1 \times 4$ sq. cm = 4 sq. cm.

**Fig (ii) :** This is a square. Each of its side measures 3cm. We can fix up nine 1cm squares.

**Fig (iii) :** This is again a square. Each of its side measure 4cm. We can fix up sixteen 1cm squares.

| Sides of the squares (in cms) | Area of the region in square units (sq. cms) |
|---|---|
| 2 | $2 \times 2$ |
| 3 | $3 \times 3$ |
| 4 | $4 \times 4$ |

Hence the area of a square = side $\times$ side

$\therefore$ $A = a \times a = a^2$ sq. unit.

($A$ = Area of the square, $a$-side of the square).

| Sides of the square in cms. | Perimeter of the square in cms |
|---|---|
| 2 | $2+2+2+2 = 2 \times 4$ |
| 3 | $3+3+3+3 = 3 \times 4$ |
| 4 | $4+4+4+4 = 4 \times 4$ |

Perimeter of a square = side $\times 4 = 4 \times$ side.

$\therefore P = 4a$ ($P$ = Perimeter; $a$ = side of the square.)

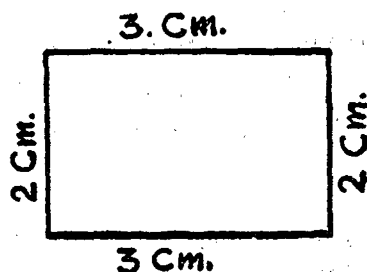



Fig. 4-4

| The length (in cms) | The breadth (in cms) | The area of the rectangle (sq cms) |
|---|---|---|
| 5 | 2 | $5\times 2$ |
| 4 | 3 | $4\times 3$ |
| 6 | 4 | $6\times 4$ |

So the formula to find the area of a rectangle is written as :

The measure of the area of the rectangle = The measure of its length × The measure of its breadth.

Therefore, the Area of the rectangle = length × breadth.

$A = l \times b$ sq. unit.

(A = Area, l-length, b-breadth)

| The length | The breadth | Perimeter |
|---|---|---|
| 5 | 2 | $5+5+2+2$ |
| 4 | 3 | $4+4+3+3$ |
| 6 | 4 | $6+6+4+4$ |

So the formula to find the perimeter of a rectangle is written as :

The perimeter of a rectangle is twice the measure of the length + twice the measure of the breadth.

In short, Perimeter of rectangle = 2 (length + breadth)

$$\therefore p = 2(l + b)$$

(P = perimeter, l-length of the rectangle, b = breadth of the rectangle)

You know that the area of the rectangle is length × breadth.

Given any two measures, we can find the third measure.

So, remember the following :

length × breadth = Area

length = Area ÷ breadth

breadth = Area ÷ length.

## Exercise 4-6

1. Express in square cms:

   (a) 1 sq.m (b) 1 sq.m 5sq decimetre.

   (c) 1 sq. m 50 sq. cm (d) 4 sq. decimetre.

2. Express in sq metres:

   (a) 1 Hectare (b) 1 Are (c) 1 Hectare 32 Are

   (d) 1 Hectare 65 sq. m.

3. Express in Ares :

   (a) 1 sq. km (b) 1 Hectare (c) 1 Hectare 50 Ares.

   (d) 1 sq. kilometres 3 Hectares.

4. Express in higher denominations:

   (a) 4,728 sq.cm (b) 12,546 sq. cm (c) 892 sq. decimetre

   (d) 1,342 sq. decimetre (e) 3,947 sq. m (f) 15,824 sq. m

   (g) 472 Are (h) 2,358 Are.

5. The measurement of the sides of four squares are as follows. Find the area in each case.

(a) 4cm (b) 3 decimetres (c) 1m 8cm (d) 70 cm.

6. The measurements of four rectangles are as follows: Find the area in each case.

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| l: | 8 cm | 3 decim | 4 m | 1 m 40 cm |
| b: | 6 cm | 2 decim 5cm | 3 m | 1 m 20 cm |

7. The length and breadth of a rectangular room are 3m and 2m 50cm respectively. Find its area.

8. The side of a square room measures 3m 50cm. Find the cost of flooring the ground at the rate of Rs. 2 per sq. m.

9. How many square handkerchiefs of side 25cm.can be cut off from a piece of square cloth of side 2m ?

10. The length of a rectangular platform is 80m. and the breadth is 60m. The cost of repairing is 25 paise per sq.m. Find the total expenditure.

11. The area of a drawing paper is 2400 sq. cms. Its breadth is 30 cm. Find its length.

12. The area of the floor of a room is 26-25 sq.m. Its length is 7 m 50cm. Find its breadth.

13. The length and breadth of the floor of a hall are 9m and 6m respectively. Square stones of side 15cm are to be fixed for this. How many stones are required?

14. The cost off flooring of square room is Rs. 300 at the rate of Rs. 7-50 per sq m. The breadth of the room is 5m, Find its length.

**4-4. The area of four walls of a rectangular room:**

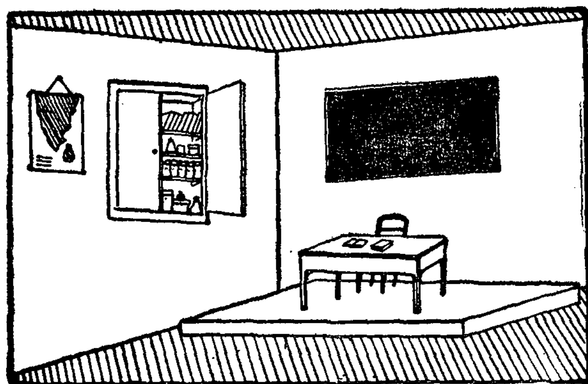


Fig. 4-5

Observe your class-room. It has four walls. It has 2 walls length wise and 2 walls breadthwise. Take a paper and fold it four times to make it a model of the four walls of your class-room. Each wall is rectangular in shape.

If we multiply the length by its height, we will get the area of one of the lengthwise walls. Similarly, if we multiply the breadth of the wall by its height we will get the area of one of the breadthwise walls.

So, the area of the lengthwise wall = length × height.

The area of the breadthwise wall = breadth × height.

The area of the four walls of a rectangular room = Area of 2 length wise walls + Area of 2 breadthwise walls.

= 2 (length × height) + 2 (breadth × height)

= 2 height (length + breadth).

In symbols,

$A = 2h\ (l + b)$ sq. unit. (where A = Area of the walls; l = length; b = breadth; h = height.)

Take a hollow match-box whose length, breadth and height are l cm, b cm. and h cm. respectively. It we cut along one of the edges and open it, we obtain one rectangle as represented in the diagram below.

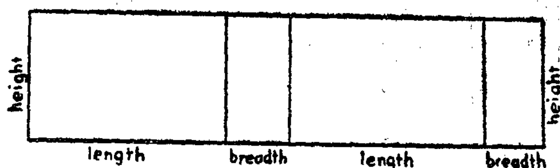



Fig. 4-6

From this we can understand that the four walls together have an area equal to that of a simple rectangle whose width is h metres (i.e. the height of the room) and whose length is $(2l+2b)$ metres (i.e. the perimeter of the floor).

Hence Area of four walls = perimeter of the floor × height.
In symbols, $A = ph$ sq. unit.
($p$ = perimeter of the floor, $h$ = height)

**Practical :**

Find the lengths, breadths and heights of the class-room walls. Using the formula find the area of the four walls of all the rooms and tabulate them.

| | Length | Breadth | Height | Area |
|---|---|---|---|---|
| 1st Room | | | | |
| 2nd Room | | | | |
| 3rd Room | | | | |

(e.g.) The length, breadth and height of a room are 4m, 3.5m respectively. Find the cost of white washing the four walls of the room at Re.1 per square metre.

Area of the four walls $= 2h\,(l+b)$

$= 2 \times 4\cdot5\ (4+3\cdot5)$ sq.m.

$= 2 \times 4\cdot5 \times 7\cdot5$ sq.m.

$= 67\cdot5$ sq.m.

Cost of white washing at Re. 1/- per sq. m. $=$ Rs $1 \times 67\cdot5 =$ Rs. 67·50

**Exercise 4-7**

1. The lengths, breadths and heights of the walls of five rooms are given below. Find the area of the four walls in each case.

| | length | breadth | height |
|---|---|---|---|
| (a) | 30 deci. m. | 24 deci. m. | 20 deci. m. |
| (b) | 35 deci. m. | 25 deci. m. | 24 deci. m. |
| (c) | 3 m. | 2·5 m. | 2·7 m. |
| (d) | 4 m. | 3 m. | 2·5 m. |
| (e) | 3·5 m. | 3 m. | 2·6 m. |

2. The length and breadth of a rectangular play ground are 200m and 180 m respectively. Find the area of the fence surrounding the grounds to a height of 2·5 m.

3. Find the cost of white washing the walls of a room of length 3·75 m width 3·25 m, and height 3·5 m at the rate of Rs. 1·60 per sq. m.

4. A rectangular field 24 m long and 20m. broad is enclosed by a wall of height 2m. Find the cost of white washing the innersides of the walls at the rate of Rs 1·20 per sq. m.

5. The measurements of a fence enclosing a rectangular house are length 100 m breadth 60m and height 2m. Find the cost of fencing the house at the rate of Rs. 4-50 per sq.m.

6. The length, breadth and height of a room are 12m 4m and 3·5 m. respectively. If the breadth of the paper is 5 deci. m. find the length of the paper needed for covering the walls.

7. The side of a square room is 8m. Its height is 3·5 m. Find the area of the four walls and the cost of painting the walls at the rate of Rs. 6 per sq. m.

We always white wash or paint the four walls excluding the areas of the windows and doors.

**Note the following example:**

(e.g.) The length, breadth and height of a room are 6m, 4m and 3·5 m respectively. It has a door 2m. by 1m, and two windows each 1·5m. by 0·8m. Find the area of the portion to be white washed.

Area of the four walls $= 2h\,(l+b)$

$= 2 \times 3{\cdot}5\,(6+4)$ sq. m.

$= 7 \times 10 = 70$ sq. m.

Area of the door $= 2 \times 1$ sq. m. $= 2$ sq. m.

Area of the 2 windows $= 1{\cdot}5 \times 0{\cdot}8 \times 2$ sq. m. $= 2{\cdot}4$ sq.m.

Total area of the door and 2windows $= 2 + 2{\cdot}4 = 4{\cdot}4$ sq. m.

$\therefore$ Area to be white washed $= (70 - 4{\cdot}4)$ sq. m.

$= 6{\cdot}56$ sq. m.

**Exercise 4-8**

1. The length, breadth and height of a room are 4m, 3·5m and 1m. respectively. It has 3 windows each 1m by 80 cm and a door 2m by 1m. Find the area of the walls excluding the door and the windows.

2. The length, breadth and height of a room are 4·5m, and 3·5m 3·2m respectively. The area of the door and windows occupy $\frac{1}{4}$th the area of the walls. Find the area of the walls to be white-washed.

3. A room 8m long, 4m wide and 5m height has 4 windows each $1m \times 0.8m$ and 2doors each $2.4m \times 1.2m$ Find the cost of white washing the walls, excluding the doors and windows at the rate of Rs. 1-20 per sq. m.

4. A square hall of side 20m is enclosed by four walls by height 5m. Find the cost of plastering the walls with cement at the rate of Rs. 60 per 100 sq. m. (Deduct $\frac{1}{5}$th of the area of the walls for door and windows).

5. A room is 7m long 6m broad and 4m high. If has 2doors each $2m \times 1m$ and four windows each $1.6m \times 0.9m$. Find the cost of papering the walls with colour paper at the rate of Rs. 2-50 per sq.m.

Area of four walls $= A = 2h\,(l + b)$

Given any three measurements in this, we can **find the fourth.**

(i) Height of the room $= \dfrac{\text{Area of the four walls}}{2(\text{length} + \text{breadth})}$

$= \dfrac{\text{Area of the four walls}}{\text{Perimeter of the base}}$

(ii) $\text{length} + \text{breadth} = \dfrac{\text{Area of the four walls}}{2 \times \text{height}}$

**Note:** Either length or breadth will be given. so the other measurement can be got.

(e g.) The area of the four walls of a room is 2·75 sq.m. Its height and length are 2·5m and 3m respectively. Find the breadth.

$$(\text{length} + \text{breadth}) \text{ of the room} = \frac{\text{Area of the four walls}}{2 \times \text{height}}$$

$$\frac{27 \cdot 5}{2 \times 2 \cdot 5} \text{ m} = 5 \cdot 5\text{m}.$$

$$\text{length} + \text{breadth} = 5 \cdot 5\text{m}.$$

$$\text{length} = 3 \cdot 0\text{m}.$$

$$\therefore \text{ breadth} = 2 \cdot 5\text{m}.$$

**Exercise 4·9**

1 The area of the four walls of a room is 30 sq. m. Its length and breadth are 4m. and 3·5m. respectively. Find its height.

2. The area of the four walls of a room is 35 sq.m. Its height is 2·5m and its breadth 3m. Find its length.

3. The area of the four walls of a room is 30·25 sqm. Its height is 27·5m and length is 3m. Find its breadth.

4. The area of the four walls of a room is 105·6 sq.m. Its height is 3m. Find the perimeter of the base. If the length is 9·4m. find its breadth.

5. The cost of white washing the four walls of a room at rate of Re.1/- per sq.m. is Rs. 44-88. Its height and breadth are 3·2m and 2·4m respectively Find its length.

6. The cost of white washing the four walls of a room at the rate of Re. 0·80 per sq m. is Rs 240. Its breadth is 12m. and height 5m. Find its length.

7. The area of the four walls of a square room is 72 sq. m. Its height is 4·5m. Find its side

8 The length of a lecture hall is 80m. and height 6m. The cost of white washing the four walls at the rate of 90 paise per sq. m. is Rs. 1296. Find its breadth.

## 4-5. Areas of square and rectangular fields :

You have learnt about the areas of squares and rectangles Now, let us consider the area of large fields and play grounds. The length and breadth of large fields and playground are measured using a meterscale or measuring tape If they are expressed as so many metres, then their areas are expressed as so many sq. metres or ares.

(e.g.) The length and breadth of a rectangular field is 80m and 40m respectively. Find its area.

Area = length × breadth

$= 80 \times 40$ sq. m $= 3200$ sq. m.

$= 32$ Ares.

Given any two of the three measures area, length and breadth of a rectangle, it is possible to find the third using the following rule.

Area = length × breadth

Length = Area ÷ breadth

Breadth = Area ÷ length

### Exercise 4-10

1. The side of a square field is 120m Express its area in ares and hectares.

2 The length and breadth of a rectangular field are 150m and 90m. respectively Express its area in ares and hectares.

3 The length and breadth of a rectangular field are 82m and 60m respectively The side of a square field is 70m. If they are available for the same amount, find out the profitable deal.

4 The length and breadth of a rectangular field are 100m and 60m respectively. How many plots of length 5m and breadth 3m can be formed?

5. The area of a rectangular field is 2 ares 40 sq.m Its breadth is 12m Find its length .

6. The area of a rectangular field is 4·5 hectares Its length is 30 decametres. Find its breadth.

7. The area of a rectangular field is 6·4 hectares. Its length is 320m. Find the cost of fencing it at the rate of Rs. 2 per metre.

8. The length and breadth of a rectangular field are 150m and 90 m respectively. Find the cost of sowing the field at the rate of Re. 1 per are. Find the distance covered by a man who goes round the field once.

9. The cost of levelling a rectangular field is Rs. 250 at the rate of Re. 0.50 per sq.m. Its breadth is 20m. Find the distance covered by a man who goes round the field once.

10. The length and the breadth of a rectangular field are 3.5 deca m. and 3 deca m. respectively. Find the cost of levelling it at the rate of Rs. 2 per sq.m. Find also the cost of fencing it at the rate of 80 paise per metre.

11. The cost of fencing a square field is Rs. 40-50. at the rate of 50 paise a metre. Find its area.

12. The area of a rectagular field is 1 hectare. Its breadth is 40m. Find its length.

13. A man pays Rs. 326-25 as tax at the rate of Rs. 36-25 per hectare If its breadth is 200m. find its length.

### 4·6 Area of triangles :

A closed figure formed by three line segments is called a triangle. You will learn about the kinds of triangles and their properties later.

You know that a triangle has 3 sides and 3 vertices. So by using set squares it is possible to draw line segments through each of the vertex which are perpendicular to their respective bases.

Consider the figure given below.

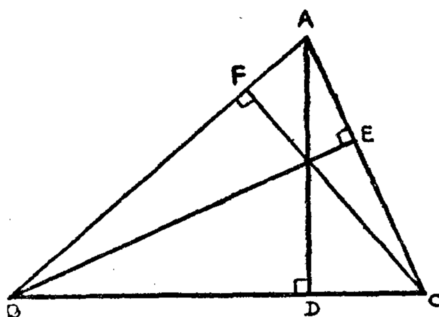



Fig. 4 - 7

In the figure, AD, BE and CF are the altitudes drawn from the vertices A,B and C respectively. Note all the three altitudes go through a point.

Draw a triangle on a graph paper. Draw a line segment through one of its vertices and perpendicular to the side opposite to the vertex.

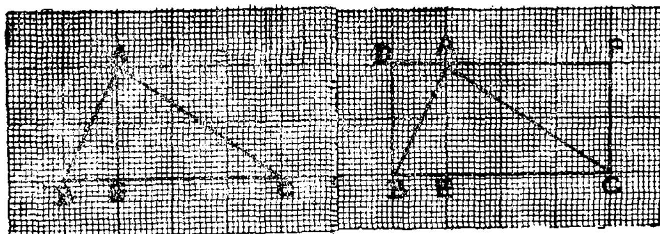


Fig. 4 - 8

Now you get two smaller triangles. viz., $\triangle$ ABE and $\triangle$ ACE. The sum of the areas of these two triangles is the same as the area of $\triangle$ ABC. Now complete the rectangles.

The sum of the areas of the two small rectangles is equal to the area of the rectangle DFCB. From this we know that the sum of the area of $\triangle$ABE and $\triangle$ACE is equal to half the total area of the two small rectangles viz., AEBD and AFCE.

$\therefore$ Area of $\triangle$ ABC = half the area of rectangle BCFD. The length of this rectangle is the base of the triangle and its breadth is the altitude of the triangle.

Area of the triangle $= \frac{1}{2} \times$ area of the rectangle
$= \frac{1}{2} \times$ length $\times$ breadth
$= \frac{1}{2} \times$ base of the triangle $\times$ Altitude.

In symbols,

$$\triangle = \frac{1}{2}\, b\, h$$

[$\triangle$ = Area of the triangle; **b** = base; h = altitude]

If any two data in the above formula are given, it is possible to find the third.

**Note**: We can take any side as the base of the triangle and the line segment which is perpendicular to it through the opposite vertex is taken as the altitude.

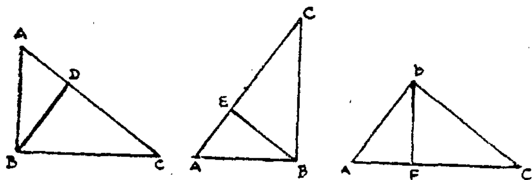



Fig. 4 - 9

**Rightangle triangle :** A triangle having one of its angles as a right angle is called a right triangle.

Consider the figure below.

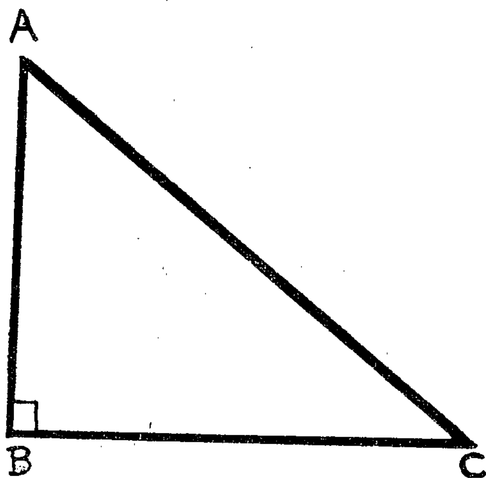



Fig. 4-10

This is a right triangle. If we consider BC as its base, AB becomes the altitude of $\triangle ABC$.

BC, AB are called the legs of the right triangle.

So area of $\triangle ABC = \frac{1}{2} BC \times AB$

$= \frac{1}{2} \times$ the product of its two legs.

Therefore the area of a right triangle

= half the product of its two legs.

**Exercise 4-11**

1. Find the areas of the figures below

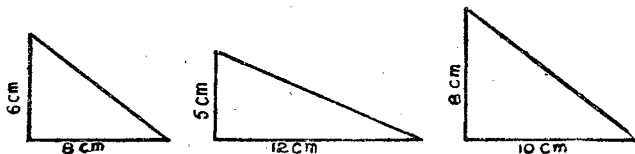



Fig. 4-11

2. Find the areas of the figures below

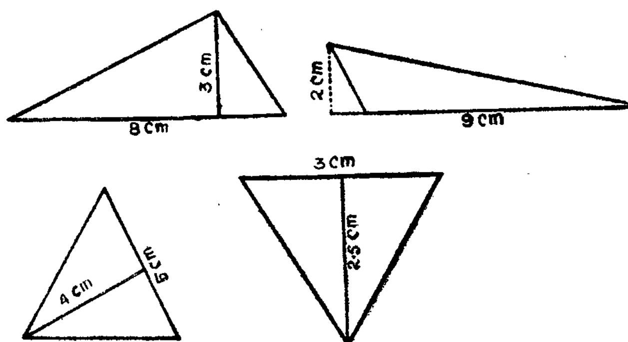



Fig. 4.12

3. Find the areas of the following triangles whose measurements are given:

| | Base — | Height |
|---|---|---|
| (a) | 7cm | 4cm |
| (b) | 8.5cn | 3cm |
| (c) | 9cm | 4.5cm, |
| (d) | 1 decimetre | 6cm |

4. The base and height of a triangular field are 125m and 42m respectively. Express its area in ares.

5. Find the areas of the following figures.

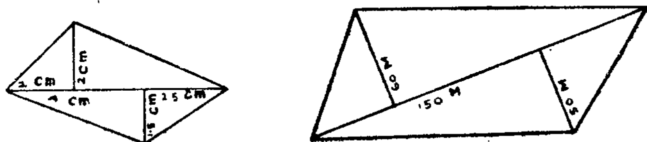



Fig. 4.13

Note: Each figure can be considered as two triangles. Find their areas separately and then add.

| | |
|---|---|
| AC = 8.5cm | PR = 150m |
| DE = 2cm | SM = 60m |
| BF = 1.5cm | QN = 50m |

6. The area of a triangle is 37.5 sq.cms. Its base is 12.5cm. Find its height.

7. The area of a triangle is 157·5 sq.m. Its height is 14m. Find its base.

8. The legs of a right triangle are 15cm and 20cm. Find its area.

9. The area of the right triangle is 150sq.cm. One of its legs is 15cm. Find the other leg.

10. The legs of a right triangular field are 60m and 80m respectively. Express the area of this field in ares.

**4-7. Cubes and cuboids-Volume and Capacity :**

The lengths of the line segments are expressed as so many metres and centimetres. Similarly, the areas of closed regions are expressed as so many sq.m. and sq.cm. Now let us consider the volume and capacity.

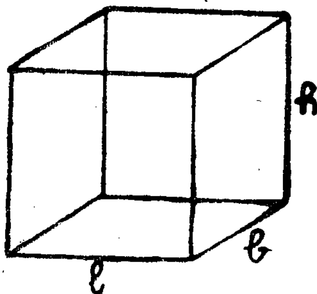



Fig. 4-14

Consider this figure. The measures of its length, breadth and height are all equal. At every vertex all the edges are perpendicular to one another. Such a solid is called a **cube**.

The space contained within the solid is called its **volume**.

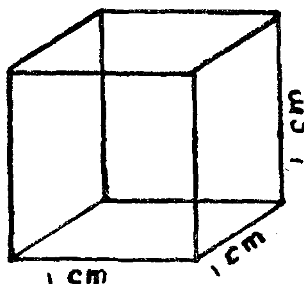



Fig. 4-15

The volume of a cube of length 1cm, breadth 1cm and height 1cm is 1 cubic centimetre.

If the cube is a hollow one, then its capacity is $1cm^3$.

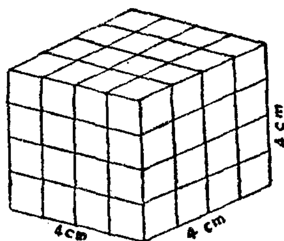



Fig. 4-16

The figure illustrates how a cube is formed out of 1 cm cubes. There are four rows at the base. Each row contains four 1cm cubes. So, there are $4 \times 4$ blocks in the array. There are four such arrays in the cube. Therefore the cube consists of $4 \times 4 \times 4$ one cm cubes. Hence, the volume of the cube is $4 \times 4 \times 4$ or 64 cubic cms. Therefore the volume of a cube = side × side × side = $(side)^3$

In symbols, $V = a \times a \times a = a^3$

[V-volume, a-side]

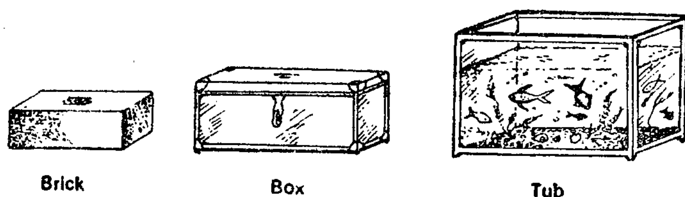



Fig. 4-17

Consider the above figures. They are having different lengths, breadths and heights.

At every vertex, all the edges are perpendicular to one another. Solids of such type are called **cuboids**. The space occupied by each one is called its volume. Look at the figure of a cuboid below.

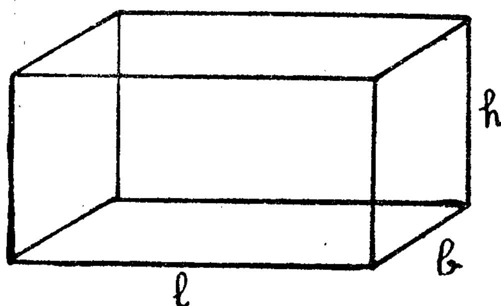



Fig. 4-18

The figure below illustrates how a cuboid is formed out of

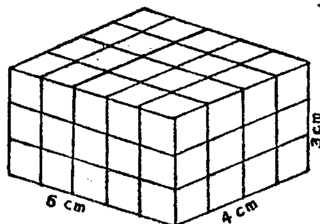



Fig. 4-19

1cm cubes. There are 4 rows at the base. Each row contains five 1cm cubes. There are $5 \times 4$ blocks in the array. There are 3 such arrays in the cuboid. Therefore this cuboid consists of $5 \times 4 \times 3$ one cm cubes. Hence the volume of this cuboid is $5 \times 4 \times 3$ or 80 cubic centimetres.

The volume of a cuboid

= length $\times$ breadth $\times$ height.

In symbols, $V = l \times b \times h$ (l-length, b-breadth, h-height)

You have learnt that 'length $\times$ breadth' is the area of the base.

$\therefore$ Volume of a cuboid = Area of the base $\times$ height

In symbols, $V = Ah$ (V—volume, A—Area of the base, h—height)

For example, the volume of a cuboid of length 4cm, breadth 3cm and height 2cm is $4 \times 3 \times 2$ or 24 cubic centimetres.

1 cubic decimetre = 1decim $\times$ 1decim $\times$ 1decim.

= 10cm $\times$ 10cm $\times$ 1cm

= 1,000 cubic centimetres.

1 cubic metre = 1m $\times$ 1m $\times$ 1m

= 10dm $\times$ 10dm $\times$ 10dm

= 1,000 cubic dm

Remember that 1,000 c. cm = 1c. dm

1,000 c. dm = 1cubic m

Capacity :

1 cubic decimetre = 1 litre

1 cubic metre = 1 kilolitre

(e.g.) 1. Find the volume of a wooden block of length 28dm, breadth 3dm and height 2dm.

$V = l\ b\ h$

$= 28 \times 3 \times 2$ cubic dm. = 168 cubic dm.

(e.g.) 2. Find the capacity of a vessel having square base of side 3·5 dm. Its height is 6 dm.

Area of the base = $3 \cdot 5 \times 3 \cdot 5$ sq dm = 12·25 sq.dm.

Capacity = $12 \cdot 25 \times 6$ cubic dm = 73·50 cubic dm.

= 73·5 cubic dm.

1 cubic dm = 1 litre.

$\therefore$ 73.5 cubic dm = 73·5 litres.

### Exercise 4-12

1. The measurements of the side of four cubes are as follows. Find the volume in each case.

   (a) 8cm (b) 8dm (c) 1dm, 5cm (d) 1m, 4dm.

2. The measurements of the length, breadth and height of four cuboids are as follows. Find the volume in each case

| | length | breadth | height |
|---|---|---|---|
| (a) | 15cm | 8cm | 1dm |
| (b) | 2dm, 5cm | 1dm, 2cm | 1dm, 5cm |
| (c) | 1m, 5dm | 1m | 1m, 2dm |
| (d) | 4m | 2m, 50cm | 2m |

3. The internal length, breadth and height of a vessel are 1dm 5cm; 1dm; 1dm 2cm respectively. Find its capacity in litres.

4. The internal length, breadth and height of a big water-tub are $4m \times 3.5m \times 3m$. Find its capacity.

5. The length and breadth of a playground is 40m and 32m. If it contains sand to a height of 5cm find the volume of the sand.

6. The length and breadth of a street is 1 Hectametre and 10m respectively. If it is to be gravelled to a height of 10cm, find the volume of the gravel in cubic metres.

7. Find the cost of building a well of 20m length 3dm breadth and height 4.5m at the rate of Rs. 15 per sq. m.

8. If a tank of 35m length, 25m breadth and 4m depth is dug out, find the volume of the earth removed.

9. The measurements of wooden block are 35 dm × 8dm × 4dm. Find the cost of the block at the rate of Rs. 8/- per cubic decimetre.

10. The measurements of a water tub are 15dm × 6dm × 8dm. If there is water to the brim find the volume of the water in litres.

11. The volume of a wooden block is 2.25 cubic metres. The length and height of it are 3m and 5dm Find its breadth.

12. The measurements of a class room are 8·75m × 6·5m × 4m. If a student requires 1·75 cubic metres of air find the number of students for whom the air in the room is sufficient.

13. The bottom of a tin in the shape of cuboid is a square of side 25cm length. The height of the tin is 6cm. Find its capacity in litres.

14. The area of a field is 0·5 Hectare. Water stands in the field to a height of 5cm. Find the volume of water.

15. The inner dimensions of a water tub are, length 42dm, breadth 30dm and height 18dm. The tube is half full of water. Find the volume of water in the tub.

## ANSWERS

### Exercise 4-1

1. (a) 3,600 seconds (b) 1,440 minutes (c) 52 weeks
   (d) 60nazhigais; 3,600 vinadis.

2. (a) 1956 A.D. (b) 1880 A.D. (c) 2000 A.D.

3. (a) Saka 1878 (b) saka 1822 (c) Saka 1850 (d) Saka 1901.

4. (a) 1978 A.D. (b) 2006 A D. (c) 1957 A.D. (d) 2028 A.D.

5. (a) 7·30 (b) 12·50 (c) 19·25 (d) 24·0 (e) 15·10

6. (a) 2·20 P.M. (b) 4·28 P.M. (c) 4·52 A.M. (d) 1·55 P.M.
   (e) 11·18 A.M.

7. After 3 hours and before 4 hours after the sun rise.

8. (a) $6\frac{1}{4}$ nazhigai (b) $8\frac{3}{4}$ nazhigai (c) 20 nazhigai.

9. 12 hours 26 min; 11 hours 34 min.

10. 23yrs. 10m. 10days; 25yrs. 9m. 6days; 21yrs. 1m. 12days.

11. 24yrs. 7m. 12days. 12. 37hours. 13. 1hour 50min.

14. 7hrs. 30min. 15. 6hrs 3min.

16. (a) 9hrs. 40min; 9hrs. 50min; 11hrs. 20min.
    (b) Cholan Express (c) Tuticorin Express.

17. (a) 5hrs. 25min. (b) Average speed 51.7 k.m/hrs.
    (c) 38min. (d) 4hrs. 47min.

## Exercise 4-2

1. 103days

2. (a) 82 days (b) 98 days (c) 80 days (d) 237 day

3. (a) Tuesday (b) Wednesday

4. 36 days 5. 2hrs. 44min.

6. 210 hours 7. 7 hrs. 51 min.

## Exercise 4-3

1. (a) 3·948m. (b) 21·15m. (c) 3·005m (d) 8·014m.

2. (a) 4·516 km. (b) 25·316 km. (c) 8km. (d) 5·008km.

3. (a) 5m/sec. (b) $7\frac{1}{2}$m/sec. (c) 10m/sec (d) $2\frac{1}{2}$m/sec

4. (a) 36km/h. (b) 90km/h. (c) 144km/h. (d) 450km/h.

5. 233m. 80cm.

6. 324km/h. 7. 29 pieces 8 71m. 4deci m. 4 cm.

9. 26m. 40cm. 10. 1,300 revolutions.

## Exercise 4-4

1. (a) 4·285 l (b) 5 l (c) 7·55 l (d) 3·6 l.

2. (a) 2·008 kl (b) 3·124 kl (c) 4·036 kl (d) 3·16 kl.

3. (a) 5·467ml (b) 3·075ml (c) 4·105ml (d) 6·050ml.

4. (a) 4,072 l (b) 10,047l (c) 5,107 l (d) 10,045 l.

5. 112 l; Rs. 201-60.

6. 22 l 750 ml.

7. 8 kl, 8 hectolitre, 2 deca litre 7l.

8. 40 Carts; Balance 205 l.

## Exercise 4·5

1. (a) 3·105 kg (b) 4 kg (c) 2·55 kg (d) 2·746 kg.

2. (a) 4·07 tonne (b) 3 tonne (c) 38·4 tonne
(d) 3·075 tonne.

3. (a) 8·75q (b) 20·18q (c) 16·98q (d) 9·89q

4. (a) 2·543 gm (b) 7,016 gm (c) 5,204 gm (d) 3,258gm

5. (a) 1,680 kg (b) 4,700 kg (c) 3,047 kg (d) 6,916 kg

6. 16q·79 kg, 500gm.

7. 1q·98 kg 500 gm.

8. 725 gm. (9) 14q 80 gm. 10. 83 kg.

## Exercise 4-6

1. (a) 10,000 sq cms. (b) 10,500 sq.cms (c) 10,050 sq.cms.
   (d) 400 sq.cms.

2. (a) 10,000 sq.m. (b) 100 sq.m. (c) 13,200 sq.m.
   (d) 10,065 sq.m.

3. (a) 10,000 are (b) 100 are (c) 150 are (d) 10,300 are

4. (a) 47 sq. deci m 28sq cm.
   (b) 1sq m 25sq deci m 46sq cm.
   (c) 8sq m 92sq deci m. (d) 13sq m 42sq deci m (e) 39are 47sq. m (f) 1 hectare 58are 24 sq m. (g) 4hectare 72are (h) 23 hectare 58are.

5. (a) 16sq cm (b) 9sq. deci m. (c) 1sq m 16sq deci m 64sq m (d) 49sq deci m.

6. (a) 48sq. cm (b) 7sq deci m 50sq. cm (c) 12sq m.
   (d) 1sq m 68sq deci m.

7. 7sq. m 20sq. deci m. 8. Rs. 24-50 9. 64 10. Rs. 1,200
11. 80 cms. 12. 3m 50cm. 13. 2,400 stones. 14. 8m.

## Exercise 4-7

1. (a) 2,160sq deci m (b) 2,880sq deci m (c) 29.70sq m
   (d) 35sq. m (e) 33·8sq m.

2. 1,900sq m 3. Rs. 78-40 4. Rs. 211-20.
5. Rs. 2,880 6. 112sq m; 224 m 7. 112sq m 8. Rs. 672.

## Exercise 4-8

1. 33·1sq m 2 38·4sq m 3. 111·04sq m; Rs. 133-25
4. Rs 192 5. Rs. 235-60.

## Exercise 4-9

1. 2m 2. 4m 3. $2\frac{1}{2}$m. 4. 35·2m; 8·2m. 5. 4·3m
6. 18m 7. 4m. 8. 80 m.

## Exercise 4-10

1. 1h 44are 2. 1h 35are 3. Rectangular field
4. 400 plots 5. 20m 6. 15 decametre 7. Rs. 2,080
8. Rs. 135; 480m 9. 90m 10. Rs. 2100; Rs. 104
11. 410·0625sq m 12. 250 m 13 450m.

## Exercise 4-11

1. 24sq cm; 30sq cm; 40sq cm

2. (a) 12sq cm (b) 9sq cm (c) 10sq cm (d) 3·75sq cm.

3. (a) 14sq cm (b) 12·75sq cm (c) 20·25sq cm
(d) 30sq cm. 4 26·25 are 5. 14·875sq cm, 82are 50sq m.

6. 6cm 7. 22·5m 8. 150sq cms 9. 20cm 10. 2·4are.

## Exercise 4-12

1. (a) 512 cc (b) 512 c deci m (c) 3c deci m 375cc
(d) 2 cubicmetre 744 deci m.

2. (a) 1c decimetre 200 cc (b) 4c deci m 500cc
(c) 1 cubicmetre 800c deci m. (d) 20 cubicmetre.

3. 1l 800ml 4. 42,000 l 5. $64m^3$ 6. $100m^3$ 7. Rs. 405
8. $3,500m^3$ 9. Rs. 8,960 10. 720 l 11. 1m 5deci m
12. 130 students 13. $3\frac{3}{4}$ l 14. 250 cubic m 15. 11,340 l

# 5. GEOMETRY

## 5·1. Knowledge of geometric figures :

We come across several geometrical shapes daily. Some of them are given below.

**Solids:**

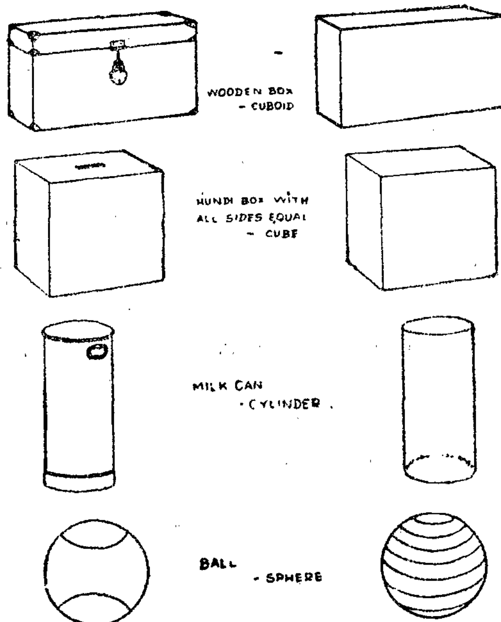



Fig. 5·1

**Plane figures :**

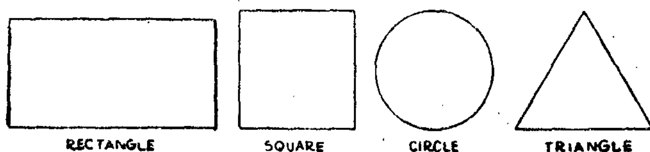



Fig. 5-2

**Example:**

Currency notes, a page of a book, the top of the table are rectangles in shape.

Bangles, ear rings, 50 p. coin are circles in shape.

You have learnt to recognise rectangles, squares and circles in the earlier classes. You may have also seen many solids of the following shapes. Their special names are also given below the figures.

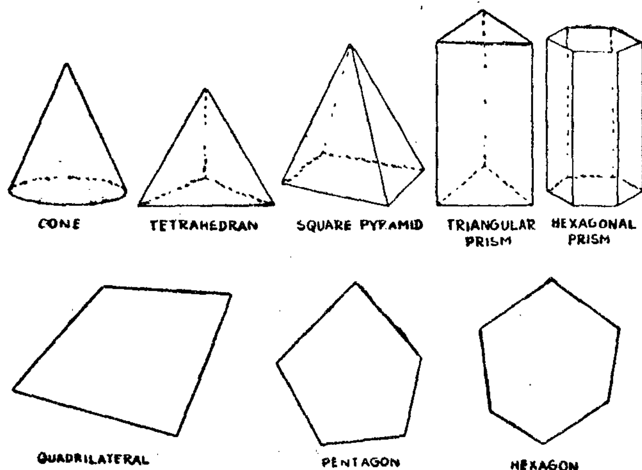



Fig. 5-3

Plane figures are given below with their names:

**Plane figures–Rectilinear figures:**

The closed figure formed by three line segments is called a **triangle**.

The closed figure formed by four line segments is called a **quadrilateral.** Rectangles and squares are also closed figures formed by four line segments. Similarly a closed figure formed by five line segments is called a **pentagon.** The closed figure formed by six line segments is called a **Hexagon.**

**Solids:**

We observe the following characteristics in the solids mentioned above.

1. The lateral faces of cubes, cuboids, triangular prisms, Hexagonal prisms, tetra hadrons and pyramids are flat.

2. The base of a cone is flat. The rest is curved. The top and the bottom of a cylinder are flat. The rest is curved.

3. The sphere has only curved surface. If a match stick is placed on any part of the flat surface, it will wholly lie on that surface. But if a match stick, however small it may be is placed on a curved surface, it will not be always wholly on the surface. It will touch it at a point.

Flat surfaces are known as planes.

A plane is a perfect flat surface extending infinitely in every direction. It is represented as shown in the figure. 5.4.

The top of a table, the floor of a room, a vertical wall, a piece of paper, the water surface in a vessel are some examples of plane surfaces.

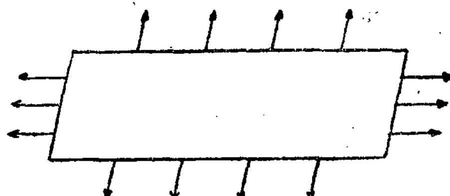


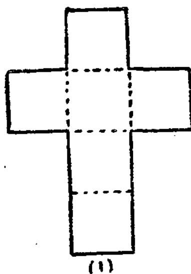
Fig. 5-4

The intersection of two faces of a solid is called on edge and the meeting point of two edges is a vertex.

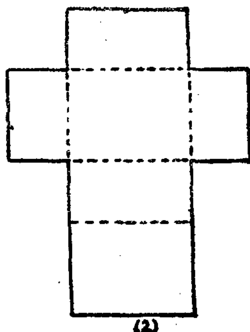
**Practical:**

Make a copy of the figures given, on a sheet of paper. Paste each of them on a piece of card-board cut along the edges of the figures. Fold along the dotted lines.

(a) Name the shape you are getting after folding as per figure (1).

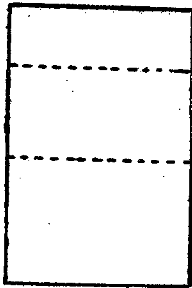


(1)

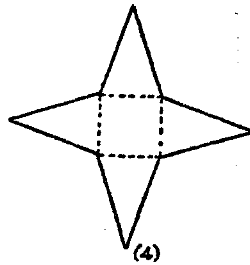


(2)

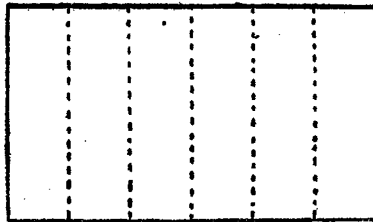
Fig. 5-5



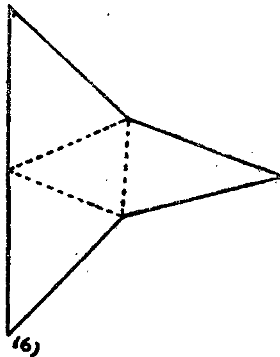
(3)



(4)

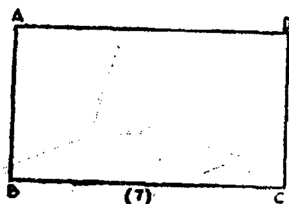


(5)



(6)

Fig 5-5



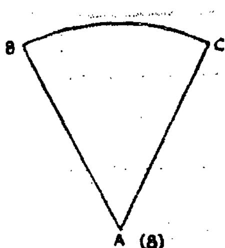




Fig 5-5

(b) Similarly name the shapes obtained by folding each of the figures 2,3,4, 5& 6.

(c) In fig. 7 join the edges AB and CD.

Name the shape obtained thus. Similarly in fig. 8 join the edges AB and AC. Name the shape obtained thus.

Exercise 5-1

1. Compare the following objects with the figures you have studied above and give their geometrical names.

(a) Ball (b) sharpened nose of the pencil (c) a book

(d) lemon (e) ruler (f) wide open portion of a funnel

(g) die (h) a full brick (i) marble (j) powder tin

(k) upper portion of a circus tent (l) laddu (m) bars of windows.

2. Fill in the table and find the relationship between V, E&F.

| Solid | Vertices (V) | Edges(E) | Face (F) |
|---|---|---|---|
| (a) Cube | | | |
| (b) Cuboid | | | |
| (c) Tetrahedran | | | |
| (d) Square Pyramid | | | |
| (e) Hexagonal Prism | | | |
| (f) Triangular Prism | | | |

3. Name the following :

(a) A solid without any edges.

(b) A solid with one vertex and one edge.

(c) A solid with only two edges and without any vertex.

(d) A solid without any vertex but having a single edge.

4. (a) What are the shapes of the faces of a cuboid?

(b) What are the shapes of the faces of a cube?

(c) What is the shape of the base of a cone?

(d) What are the shapes of the flat surfaces of a cylinder?

(e) Find out the shapes of the faces of a tetrahedran ?

(f) How many sides of triangular shape are in a square pyramid?

(g) What is the shape of the base of a hexagonal prism?

**5-2. Line, Line Segment, Ray, Angle (Revision) :**

**1. Line**

A line is a concept. A streak drawn along the edge of a ruler is a representation of a line. 'A line' means 'a straight line'. A line extends infinitely in both directions. Usually we shall indicate this in our illustrations by drawing arrow heads at two extremes,




Fig. 5-6

The arrow-heads are meant to remind us that the line does not stop at any point. It may be extended to any required length. The illustration represents the line AB. This is noted as AB.

2. **Point :**

Point is a concept. We denote a point by a dot. But if you think of smaller and smaller dots, made by sharper pencils, you will get a good idea of what we mean in geometry by the word point.




Fig. 5-7

3. **Line Segment :**

A portion of the line having two end points is called a segment. It shall be represented by a streak having two end points.




Fig. 5-8

It is possible to measure the length of a segment. It is impossible to measure the length of a line.

If the measures of two segments are equal, then they are called congruent segments :

4. **Ray :**




Fig. 5-9

On the line AB, mark a point O. A ray is that part of the line starting at O, and proceeding through B. It goes on for ever in the same direction without any end. OB is a ray. So also OA is another ray.

A ray looks like this. Ray OB is noted as OB.




Fig. 5-10

5. **Angle :**

In the figure OA, OB are rays. They do not lie on a line. They have only one common end point.

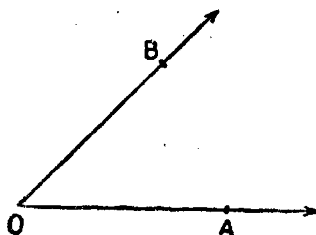



Fig. 5-11

**Two rays have a common end point, but do not lie on the same line. They form an angle.**

We represent this angle thus- $\underline{|AOB}$ or $A\hat{O}B$.

The hands of a clock form an angle. A ladder leaning on a wall makes angles with the wall and the floor.

You may have come across such examples in your daily life.

The line segments are measured with a graduated ruler. Similarly the angles are measured with a protractor. The number of degrees in an angle is called the measure of the angle. If there are 60 degrees in an angle AOB, the measure of the angle is written thus:

m $\underline{\lfloor AOB}=60$. (m—the symbol for measure).

If the measures of two angles are equal, then the two angles are congruent.

**Kinds of angles :**

If the measure of an angle is 90, then it is called a **right angle**.

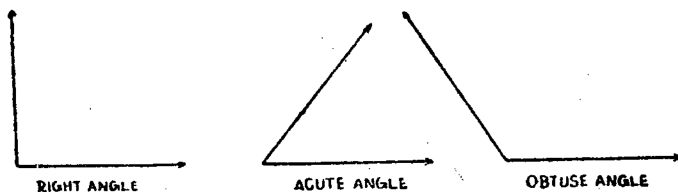



Fig. 5-12

Any angle whose measure is less than 90 is called an **acute angle**.

An angle whose measure is greater than 90 but less than 180 is called an **obtuse angle.**

**Exercise 5-2**

1. (a) How many points are there on a line?
   (b) How many points are there on a segment?
   (c) How many points are there on a ray?

2. Plot four points, no three of which are on the same line. Draw lines through pairs of points. Find the number of lines. Find the number of segments.

3. (a) Find the measures of the angles formed in the following illustrations.

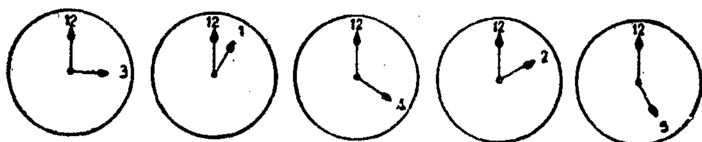



Fig. 5-13.

(b) A man stands facing the east. Then he turns to his right and faces the directions noted below. Find the measures of the angles through which he has turned.

(i) South (ii) North (iii) South East (iv) South West (v) North East (vi) again East.

4.

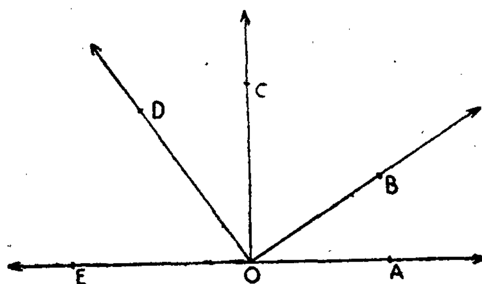



Fig. 5-14

In the above figure m $\angle AOB = 30$, m $\angle BOC = 60$, m $\angle COD = 40$, m $\angle DOE = 50$. Hence find the measure of each of the following angles.

(a) $\angle BOE$ (b) $\angle COE$ (c) $\angle AOD$ (d) $\angle BOD$

(e) $\lfloor AOC$ (f) Name three obtuse angles (g) Name four acute angles (h) Name two right angles.

**5-3. Line:**

**Practical:**

(i) On a piece of paper plot a point. Draw the lines passing through this point. How many such lines can be drawn through that point?

(ii) Plot the points on a piece of paper. Draw a line passing through these points. Investigate the number of lines which can pass through these two points.

(iii) Plot two points on a piece of paper. Draw a curved line passing through the points. How many such curved lines can be drawn through these two points?

(iv) Which is the shortest distance between two given points? We have learnt from this experiment that

(i) Large number of lines pass through a point.
(ii) Only one line can be drawn through any two points.
(iii) Innumerable curves can be drawn through any two points.
(iv) The line segment is the shortest path joining two given points.

Two lines either intersect each other or do not intersect. When they intersect, they intersect, at only one point. If two lines on the same plane do not intersect, they are called **parallel lines.**

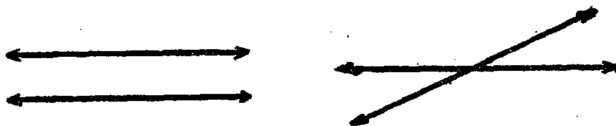


Fig 5-15

**Collinear points :**

In the adjoining figure the points A, B, C lie on the line AC. The points D, E, F lie outside the line AC.

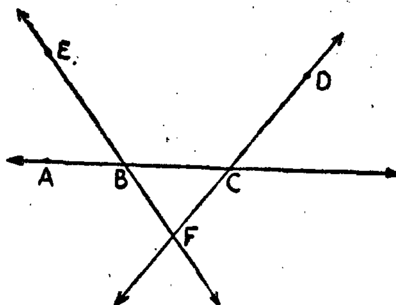



Fig. 5-16

Points lying on a line are called **collinear points.**

In the figure A, B, C, are collinear points. Similarly E, B, F are also collinear points. Find another set of points which are collinear.

**Concurrent lines:**

In the adjoining figure the lines AB, CD, EF and GH pass through the point P.

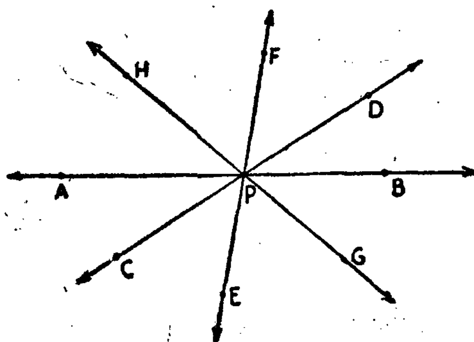



Fig. 5-17

Lines passing through a point are called **Concurrent lines.** In the figure AB, CD are concurrent lines. Which other lines are concurrent with AB and CD ?

**Perpendicular lines :**

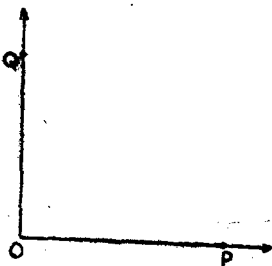



Fig. 5-18

If the rays OP and OQ make an angle whose measure is 90, then they are said to be **perpendicular** to each other.

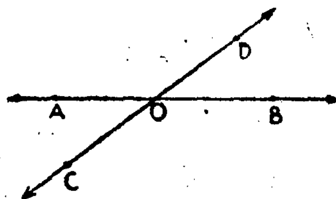



Fig. 5-19

In the adjoining figure lines AB and CD intersect at O. There are four rays at O. (OA, OB, OC, OD).

If two intersecting lines cut at a right angle, then they form four right angles. The lines are perpendicular to each other.

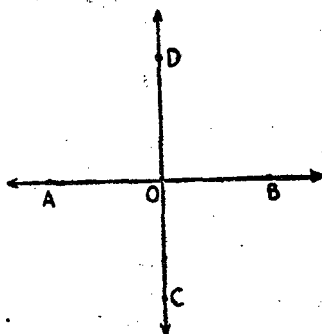



Fig. 5-20

In the figure 5-19, AB is not perpendicular to CD. In the figure 5-20, AB is perpendicular to CD.

Given a point on a line, only one line can be drawn perpendicular to that line. How can we draw this perpendicular? Take a set-square and place it such that the vertex containing the right angle coincides with the given point. Adjust the set square such that one of the arms containing the right angle coincides with the given line. Mark a point close to the other arm containing the right angle. Join this point with the given point on the line. This line will be perpendicular to the given line.

You know that there are innumerable points on a line. Through each of these points, lines perpendicular to the given line can be drawn. Hence there are innumerable perpendicular to a line through the points on it.

**Distance between a line and a point :**

Fix a piece of paper on a drawing board. Draw AB. Plot an external point P. Fix a pin perpendicular to the board.

Tie a thin string to that pin. Stretch the string in different positions so that it intersects AB in each case. Mark with ink the positions where the string intersects AB. Note that the distance between the pin and the ink marks gradually decrease at first, reach a point where from it begins to increase. Mark the point where the change occurs on AB as C. Join CP. PC will be the shortest distance from P to AB. Measure the angle BCP. The measure will be 90.

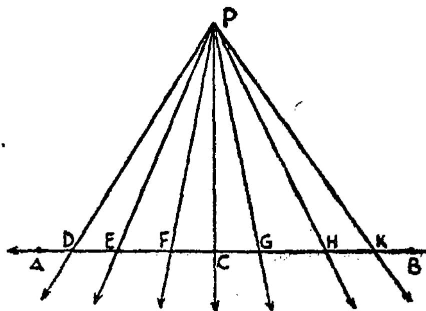



Fig. 5-21

From this experiment, you learn that the **shortest segment joining a point to a line is the perpendicular segment.**

The distance between a line and an external point is the length of the perpendicular segment from the point to the line.

**Mid-point**




Fig. 5-22

**Oral :**

Look at the figure and answer the following questions:

1. Find the measure of segments AC and CB. Are they equal?
2. Find the measure of AD and DB. Are they equal?
3. Find the measure of AE and EB. Are they equal?
4. Find the measure of AF and FB. Are they equal?
5. Find the measure of AG and GB. Are they equal?
6. Find the point on AB which is equidistant from A and B. This point is called the mid-point of the segment AB.
7. Find the mid-point of $\overline{AF}$.
8. Find the mid-points of AD,CG,DF,DB and FB.

The point P is called the mid-point of a segment AB if P is between A and B and AP = PB, Every segment has exactly one mid-point, **The mid-point of a segment is said to bisect the segment.**

**Parallel lines:**

In a plane, any two non-intersecting lines are called parallel lines.

(e.g.) 1. The opposite edges of a table.

2. The horizontal reapers of windows and doors.

3. The vertical reapers of windows and doors.

4. The two rails of the railway line.

Measure the distances between the two opposite edges of a table.. This distance will always be equal. Hence **the distances between two parallel lines will always be equal.**

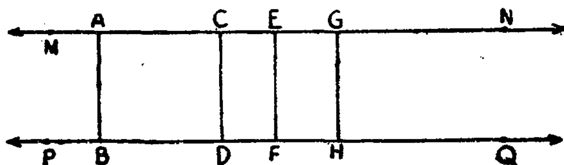



Fig. 5-23

PQ is parallel to MN. Therefore AB = CD = EF = GH.

Plot two points P,Q on the line AB. Draw PX perpendicular to AB. and QY perpendicular to AB. These two lines will be equidistant from each other.

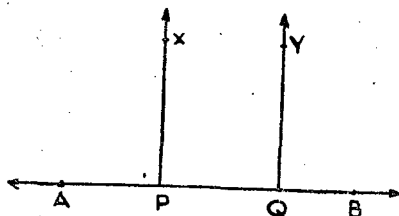



Fig. 5-24

**So two lines which are perpendiculars to a third line will be parallel to each other.**

## Exercise 5-3

1. How many lines can pass through a point in a plane? How many curved lines can pass through a point in a plane?

2. How many lines can pass through two points in a plane? How many curved lines can pass through two points in a plane?

3. How many lines can pass through three non collinear points in a plane? How many curved lines pass through them?

4. How many lines can pass through any four non-collinear points in a plane? How many curved lines can pass through them?

5.

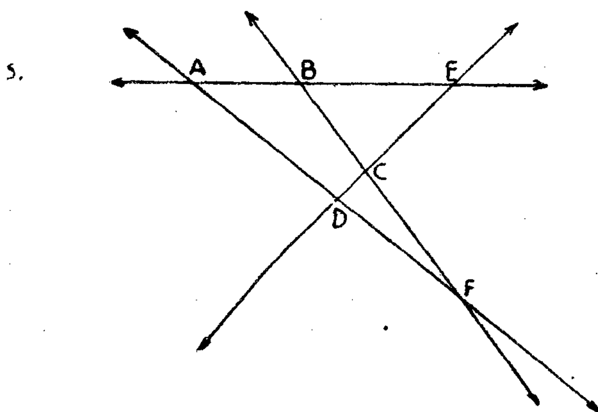



Fig.5-25

In the figure given above find out which of the following sets of points are collinear.

(a) (A,D,F) (b) (A,B,E) (c) (D,C,B)

(d) (A,B,C) (e) (A,E,D) (f) (D,C,E).

(g) (C,D,A) (h) (B,C,F) (i) (A,C,F) (j) (C,F,D)

6. How many perpendiculars can be drawn to a line through a point on it?

7. Which is the shortest segment joining a point to a line?

8. How many mid-points does a segment have?

9. How many lines can be drawn parallel to a given line?

10. AB is parallel to CD. CD is parallel to EF. Investigate whether AB and EF are parallel.

11. Where do the non-parallel lines intersect?

12. What is the name of the lines in a plane which are equi distant from each other?

13. Draw four lines.

 (a) intersecting at one point.

 (b) intersecting at 3 points.

 (c) intersecting at 4 points.

 (d) intersecting at 5 points.

 (e) intersecting at 6 points.

14. Draw three lines satisfying the given condition: (a) Intersecting at one point (b) Intersecting at 2 points (c) Intersecting at 3 points.

## 5-4. Planes

### 5-4. 1. An investigation in a plane

**Practical**. On a wooden plank nail three nails, each measuring 10cm. They should not be on a line.

(a) Place a plane card-board so that it may touch the head of one of the nails. In how many positions can this be placed in this manner?

(b) Place a plane card-board so that it touches the head of the two nails. In how many positions can this be placed in this manner?

(c) Place a plane card-board so that it may touch the heads of three nails. In how many positions can this be placed in this manner?

(d) Stretch a string tightly so that it touches the heads of any two nails. In how many ways can a plane card-board be placed so that it touches the entire portion of the string?

(e) Repeat as in (d). Then place the board so that it may touch the head of the third nail. In how many ways can that board be placed in this manner?

(f) Stretch a string tightly touching the heads of any two nails. Stretch another string tightly touching the head of the third and any one of the two nails. Place the card-board touching these two strings. In how many ways can the board be placed in this manner?

Consider the three heads of the nails as points lying on a plane, the card board as a plane and the stretched string as a line. From the above experiments, you would have seen the following:

(a) **Innumerable planes pass through a point**

(b) **Innumerable planes pass through two points.**

(c) **Only one plane passes through three non-collinear points.**

(d) **Innumerable planes pass through a line.**

(e) **Only one plane passes through a line and a point not on it.**

(f) **Only one plane passes through two intersecting planes.**

**Necessary and sufficient conditions to determine a plane.**

(i) To determine a plane, we need three non-collinear points. More briefly, any three points are coplanar and any three non-collinear points determine a plane.

(ii) Given a line and a point not on the line there is exactly one plane containing both of them.

(iii) Given two intersecting lines, there is exactly one plane containing both.

### 5-4. 2. The intersection of two planes:

Two planes either intersect each other or do not intersect. When two planes do not intersect, then we say that the planes are parallel to each other. When the two planes intersect, their intersection is a line.

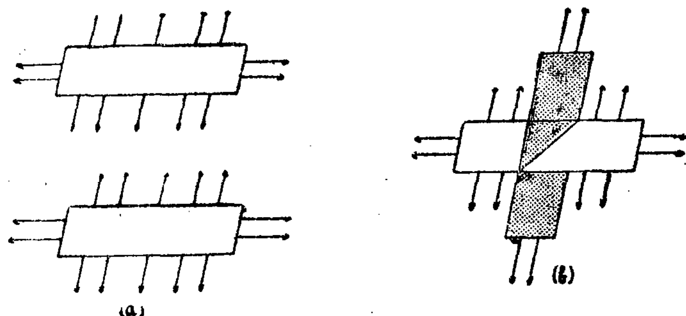



Fig. 5-26

### 5-4. 3. Intersection of a line and a plane :

**Practical :**

(1) Hold a straight thin stick parallel to a card-board. Do they intersect? If they intersect, mark it.

(2) If the stick is not parallel to the card-board see whether they intersect. If they do so, mark it.

(3) Place the straight thin stick on the card-board. Do they intersect? If they do so, mark it.

(4) Considering the straight thin stick as a line, and the card board as a plane, what are the facts you discover? We discover that.

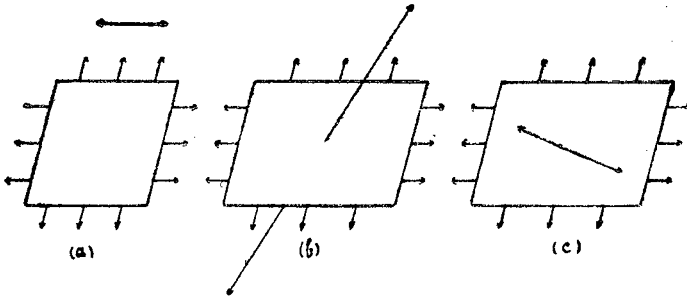



Fig. 5-27

(a) A line which is parallel to a plane does not intersect the plane (fig-a).

(b) A line which is not parallel to a plane intersects the plane at a point (fig-b).

(c) A plane and a line which wholly lies in the plane, intersect on the line itself (fig-c).

**Skew lines :**

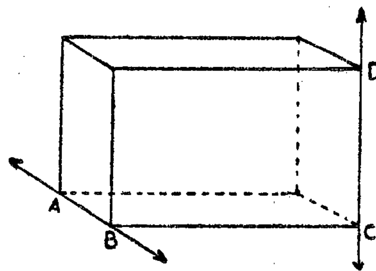



Fig. 5-28

Consider AB and CD as the two edges of a Cuboid. The lines passing through them do not intersect. Further these lines do not lie in the same plane. They lie on different planes. If two

**Coplanar lines do not intersect they are called parallel lines. The two non-intersecting non-coplanar lines are called skew lines.** In the figure AB and CD are skew lines.

For example, consider the line $l_1$, which runs from back to front along the floor of your room and the line $l_2$ which runs from side to side along the ceiling. They are skew lines.

**Exercise 5-4**

1. How many planes can pass through a point in space?
2. How many planes can pass through two points in space?
3. How many planes can pass through any three non-collinear points in space?
4. How many planes can pass through any four non-collinear points in space?
5. How many planes can pass through a line?
6. How many planes can pass through two intersecting lines?
7. How many planes can pass through two parallel lines?
8. What is the intersection of two planes?
9. What is the intersection of a line and a plane?
10. What is the intersection of a plane and a line lying on it?
11. What is the name of the line which is equidistant from a plane?
12. In the adjoining figure name pairs of skew lines.

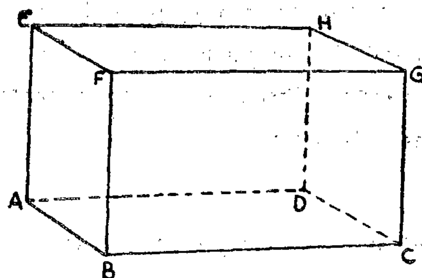



Fig. 5-29

## 5-5. Plane figures and their properties : Rectilinear figures

Triangles, Rectangles, squares, quadrilaterals are a few examples for rectilinear figures.

### 5-5. 1. Triangle :

Plot three non-collinear points A,B and C on a sheet of paper. Draw AB, BC and CA. The figure thus got is called a triangle. In the illustration, the segments AB, BC, CA are called the vertices of the triangle. At each vertex, an angle is formed. Therefore, a triangle has 3 vertices, 3 sides and 3 angles.

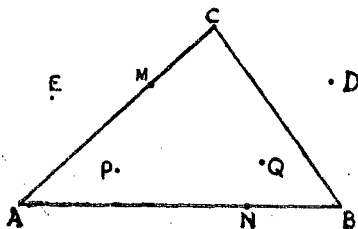



Fig. 5-30

In the adjoining illustration P and Q lie in the interior of the triangle. M and N lie on the triangle. D and E lie on the exterior of the triangle. Therefore, a triangle separates the plane into three regions. They are:

(1) Points in the interior of the triangle.

(2) Points on the triangle itself and,

(3) Points exterior to the triangle.

**Some properties of the triangles;**

1. You know of all the paths joining to points, the line segment is the shortest. So **the sum of the lengths of any two sides of a triangle is greater than that of the length of the third side.**

(a) The sum of the measures of the three angles of a triangle can be found either (i) by paper folding or (ii) by cutting the angles and replacing them as shown in the illustration.

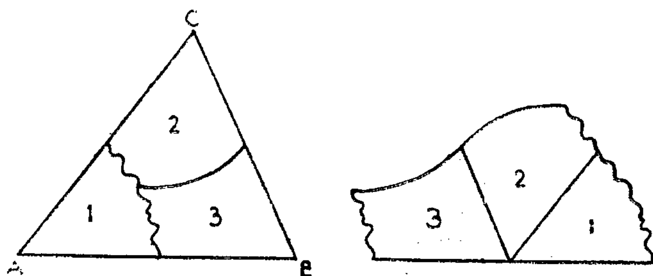



**Fig. 5-31**

From these, we know that **the sum of the measures of three angles of a triangle is 180.**

**Kinds of triangle :**

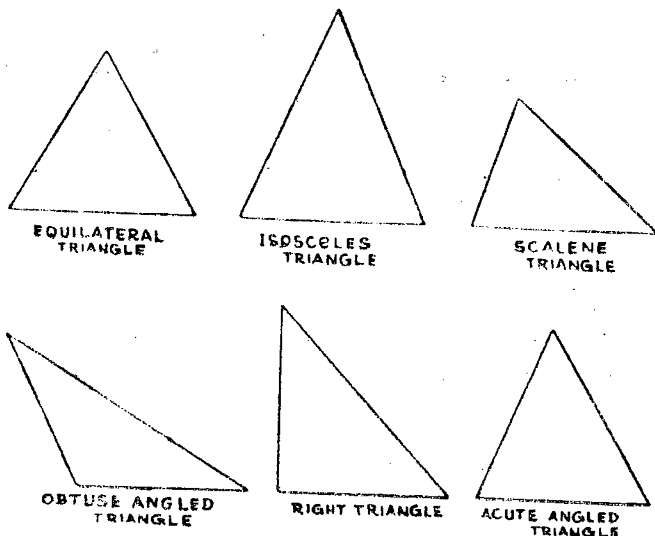



Fig. 5- 32

i. *(a)* A triangle, whose all the three sides are congruent is called an **equilateral triangle**.

*(b)* A triangle, any two of whose sides are congruent, is called an **isosceles triangle**.

*(c)* A triangle, no two of whose sides are congruent, is called a **scalene triangle**.

Thus triangles can be classified into three kinds by comparing **the lengths of the three sides.**

ii (a) If the measure of any one of the three angles is greater than 90 (obtuse), then it is called an **obtuse angled triangle.**

(b) If the measure of any one of the three angles is 90, then it is called **a right triangle.**

(c) If the measure of each of the three angles of a triangle is acute (that is less than 90), then it is called an **acute angled triangle.**

Thus triangles can also be classified into three kinds by comparing the measures of angles of a triangle.

**2. Rectangles :**

The edges of windows, doors, table top, post card have a shape as shown in the figure.

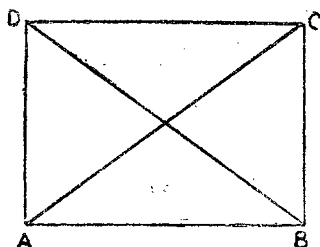



Fig. 5·33

**This figure is called a rectangle.**

In the figure, **AB** and **CD** are called the lengths, **AD** and **BC** are called the breadths. AC and **BD** are called the diagonals. You know how to draw a rectangle.

**Practical :**

Take a rectangular sheet of paper. (i) Is it possible to fold the paper so that the lengths coincide? (ii) Is it possible to fold the paper so that the breadths coincide? (iii) Using the dividers, compare its diagonals. (iv) Using the protractor measure the angles A, B, C and D. Compare them. (v) Compare the measures of AO, BO, CO and DO.

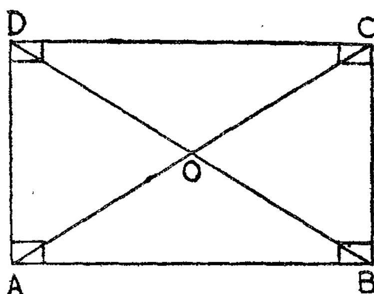



Fig. 5-34

You will notice that in a rectangle.

(i) **Lengths are congruent, breadths are congruent.**

(ii) **Diagonals are congruent.**

(iii) **The four angles are congruent; each measure being 90 .**

(iv) **The diagonals bisect each other; each of the four segments so obtained are congruent.**

**Squares :**

If all the four sides of a rectangle are congruent, then the rectangle is a square. Hence, square is also a rectangle. All the properties of a reetangle hold good for a square also.

Properties of a square :

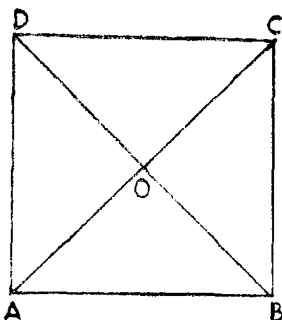



Fig. 5·35

1. All the four sides are congruent.

2. The diagonals are congruent.

3. Four angles are congruent, the measure being 90°.

4. The diagonals bisect each other.

5. If the point of intersection is O, then the segments OA, OB, OC and OD are congruent.

6. The diagonals are perpendicular to one another. (In a rectangle it is not so.)

4. Circles :

Place the lid of a bottle on a sheet of paper. Draw the outline of it using a pencil. You will get a figure like this. This figure is called a circle.

The points A and B lie in the interior of the circle. The points C and D lie in the exterior of the circle. The points P and Q lie on the circle.

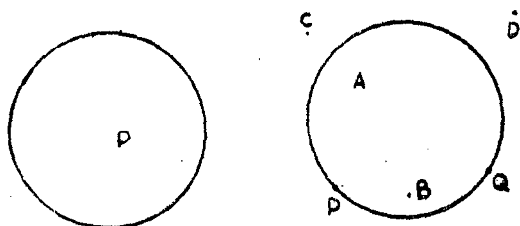



Fig. 5-36-37

Therefore **a circle separates the plane into three regions.** They are as follows:

(1) The points on the circle.

(2) The points that lie in the interior of the circle and.

(3) The points that lie on the exterior of the circle.

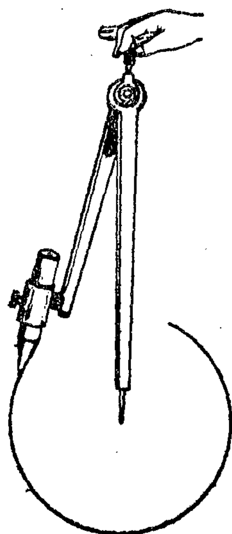


Fig. 5 - 38

Mark a point P on a sheet of paper. Keep the sharp point of the compasses on P. Stretch the arms to some measure of segment. Rotate the compasses. The figure we get is called a circle. The point P is the **centre of the circle**. Note that **the centre does not lie on the circle.** Draw a line through the centre. Let this intersect the circle at A and B. The segment AB is a **diameter.** Using a divider compare the measures of a radius and a diameter. You will find that **the measure of diameter of a circle is twice the measure of its radius.**

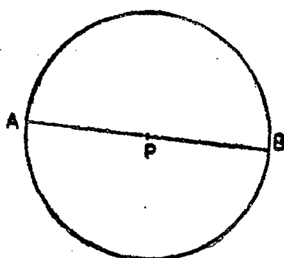


Fig. 5-39

Investigate the number of diameters that can be drawn. How many radii (plural for radius) can be drawn?

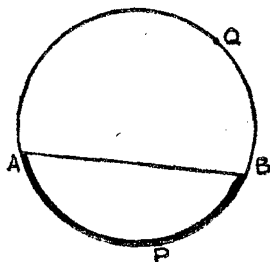


Fig. 5-40

The points A, B lie on the circle. The curve APB which joins A and B is called an **arc**. The curve AQB which joins A and B is called an arc. The smaller curve APB is called the **minor arc** and the longer curve AQB is called the **major arc.** The segment AB is called the **Chord.**

Draw as many chords as possible. Measure each of them. Which is the greatest chord among them?

Starting from a point on the circle and move on it till we reach the same point. The distance covered is one revolution of a circle.

**This revolution is called the circumference of a circle.**

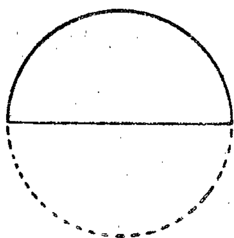


Fig. 5-41

Fold a circular sheet of paper about one of the diameter. The two parts coincide. **A diameter bisects the circle into two semi-circles.**

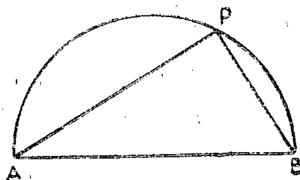



Fig. 5-42

Construct a semi circle; Join any point P on the circumference with the end points of the diameter, *viz*, A and B. Measure the angle $\angle APB$. You see that m $\angle APB = 90°$. Therefore, the **angle in a semi circle is always a right angle.**

## Exercise 5-5

1. Can there be two right angles in a triangle?

2. Can there be two obtuse angles in a triangle?

3. Which of the following can be the angles of a triangle? State the reasons.

   (a) 60°, 70°, 80° (b) 30°, 40°, 50° (c) 50°, 60°, 70°

   (d) 45°, 90°, 45° (e) 60°, 40°, 80° (f) 90°, 90°, 100°.

4. Find the measure of the third angle of each of the triangles whose other two angles are as follows :

   (a) 70°, 40°, (b) 50°, 80° (c) 100°, 60°.

5. Can a triangle be constructed with the following sides ?

   (a) 5 cm, 6 cm, 7 cm (b) 8 cm, 5 cm, 3 cm

   (c) 10 cm, 4 cm, 5 cm (d) 6 cm, 10 cm, 12 cm

   (e) 8 cm, 2 cm, 4 cm (f) 11 cm, 6 cm, 5 cm

6. Name the kinds of triangles each of which having the following measures of angles :

   (a) 50°, 60°, 70° (b) 30°, 40°, 110°

   (c) 60°, 30°, 90° (d) 45°. 45°, 90°

7. (a) Can a square be considered a rectangle ?

   (b) Can a rectangle be considered a square ?

   (c) Can a diameter be considered a chord ?

   (d) Can a chord be considered a diameter ?

8. Find the length of a diameter of the circle having a radius of length.

   (a) 3·5 cm (b) 6 cm (c) 12 cm

9. Find the length of a radius of the circle having the following as length of diameter.

(a) 8 cm (b) 12 cm (c) 7 cm

10. (a) How many centres can a circle have ?

(b) How many radii can a circle have ?

(c) How many diameters can a circle have ?

(d) How many chords can a circle have ?

11. Arrange 15 match sticks as shown in the figure. Remove 3 match sticks to form 3 squares.

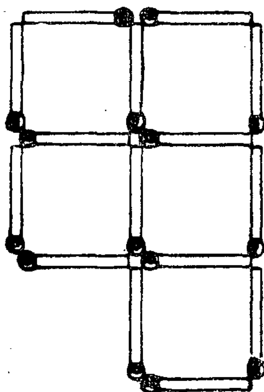
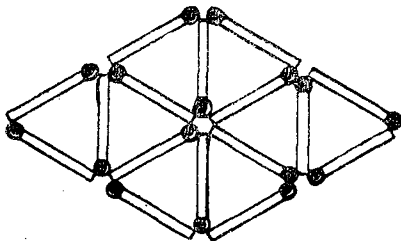


Fig. 5-43

12. Arrange 16 match sticks as shown in the figure. Remove 4 match sticks to form 4 equilateral triangles.



Fig, 5-44

13. Arrange 9 match sticks as shown in the figure.

(a) How many equilateral triangles are there in this figure ?

(b) Remove 4 match sticks to form 2 equilateral triangles.

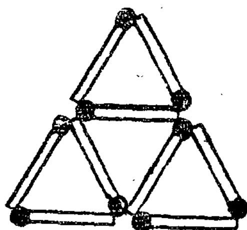


Fig. 5-45

(c) Remove 3 match sticks to form 2 equilateral triangles.

(d) Remove 2 match sticks to form 2 equilateral triangles.

## 5-6. Constructions .

### 5-6.1. Geomentrical instruments and their uses :

The following instruments are in the Mathemetical instruments box .

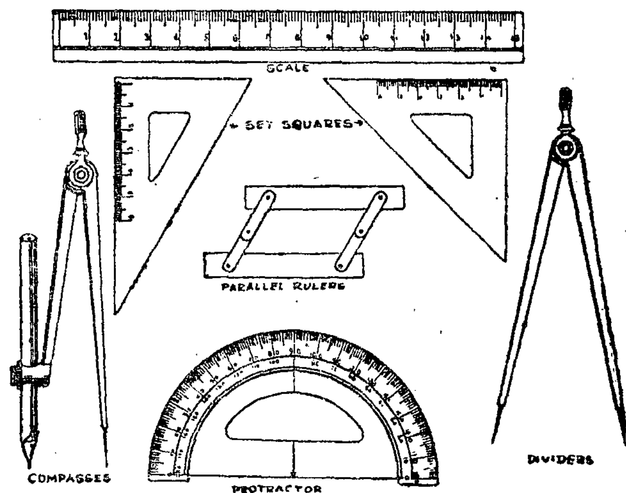



Fig 5 - 46.

**(a) Scale or graduated ruler :**

One edge of the scale is graduated in centimetres and millimetres and the other edge is graduated in inches and $\frac{1}{10}$ of an inch. Is used :

i) for drawing a line.

ii) for measuring a line segment.

**(b) A pair of compasses :**

A compass helps us to draw a circle with a given radius. It is also used to cut a line segment of given length on a line.

**(c) The divider :**

It is used to measure line segments and compare the lengths of any two segments.

**(d) Set squares :**

It is used to draw lines perpendicular to a given line with a pair of set squares, we can draw a line parallel to given line.

**(e) Protractor :**

Parallel lines can also be drawn to a given line using parallel rules. Its semi-circular edge is divided into 180 equal parts. Each division is called ' a degree '. The marking begins with zero at the outer right side and ends with 180 at the outer left side. At the inner edge the marking begins in the zero at the left side and ends with 180 at the right side. It is used to measure angles. It is also used to construct an angle to a given measurement.

## 5-6. 2. Construction of angles through paper folding :

A piece of paper of any shape is folded once The second fold is made in such a way that the edges coincide (Refer the illustration given below). Measure the angle. It is a **right angle.**

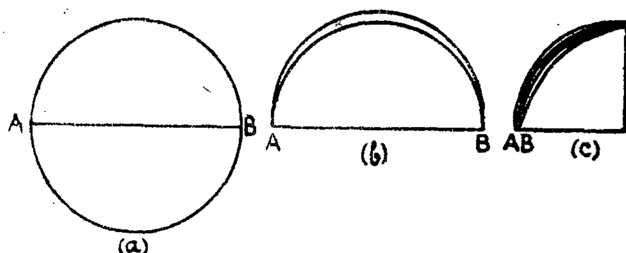



Fig. 5 - 47

Fold again, so that the two arms of the angle coincide again. Measure the angle. An angle of measure 45° is obtained.

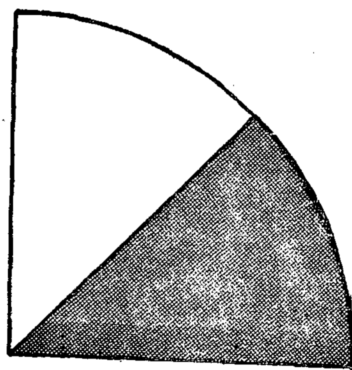


Fig. 5-48

Fold a sheet of paper. Mark a point P on the edge of the fold. Make two folds through the point P one over the other by trial and error. These two folds decide the paper into three equal parts. Measure the angle so formed. It will be 60°.

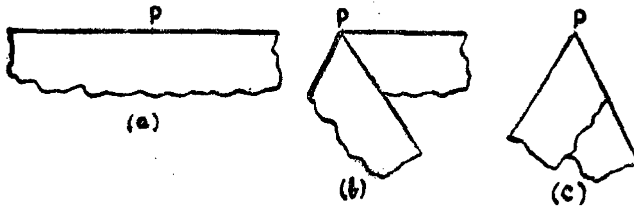



Fig. 5-49

If one layer is unfolded, an angle measure of 120 is obtained.

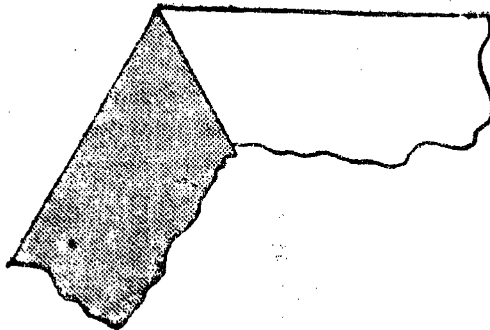


Fig. 5 - 50

Fold the portion corresponding to the angle measure 60 such that the arms of the angle coincide. The angle measure 30 is obtained.

If we unfold all the layers, we get six equal parts. Fold one layer and measure the angle. The angle measure of 150 is obtained.



Fig. 5-51.

**5-6. 3. Construction of a line segment of a given length :**

*(e.g.)* Draw a line segment whose length is 8cm.

**Method of Construction :** Draw a line XY using a ruler. **Mark a** point A on it. Place the pointed leg of the compass **on 0 of a** ruler and spread the other so that it pitches 8cm on the ruler. Place the pointed leg of the compasses on the point A and cut an arc on the line XY. Let this point be B. **AB** is the required line segment whose measure is 8cm.

**5-6. 4. Construction of an angle of given size :**

*(e.g.)* Construct an angle whose measure is 60° using a ruler draw the ray AB. Place the protractor in such a way that the mid-point of the base of the protractor coincides with the end point A of the ray and the ray coincides with the edge of the Protractor.

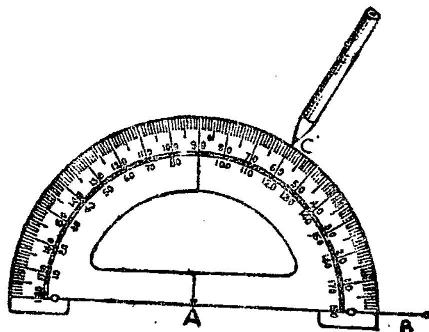



Fig. 5-52

Find the given number (i.e. 60°) on the semi-circular edge of the Protractor. Start counting from the Zero near to B and place a dot C against the number 60° and close to the circular edge. Join AC.

**5·6. 5. (a) Bisection of line segments through paper folding :**

On a sheet of paper draw a line segment AB to the given measurement. Fold the paper in such a way that A coincides with B. The crease bisects the given line segment.

**(b) Bisection of an angle through paper folding:**

Draw an angle on a sheet of paper to the given measurement. Fold it so that the arms coincide. Then the crease bisects the angles into two congruent angles.

**5·6. 6. (a) Drawing a parallel line using parallel ruler:**

Paraller ruler is used to draw parallel lines

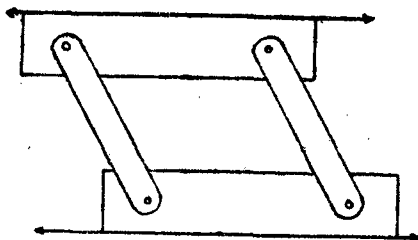


Fig 5·53

The parallel ruler has got two frames. Keep one of the frame of the ruler on the given line. Place the other frame in the required position and draw the parallel line.

**(b) Drawing a parallel line using the set square :**

Keep one edge of a set square on the given line as shown **in the figure** (i).

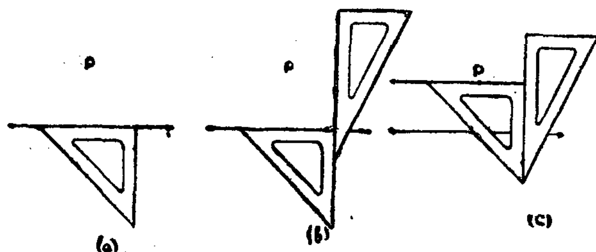
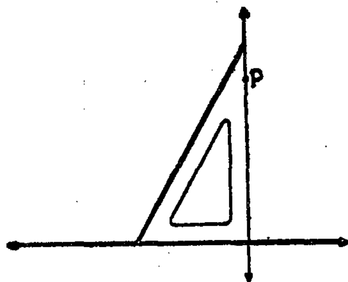



Fig. 5-54

Match the other edge of the first set square with an edge of the other set square as in figure (ii) keep this fixed and move the first set square along the edge of the fixed set square and draw the line parallel to the given line through the other edge.

**5-6.7. Drawing a perpendicular line to a given line from a point outside it using set square :**




Place one of the two edges (which contain the right angle) of the set square on the given line. Move the set square in such a way that the other edge passes through the given point. Draw a line close to this edge passing through the given point. This is the required perpendicular.

### 5·6.8. Construction of a circle of given radius :

(e.g.) Draw a circle of radius 5 cm.

Mark a point P on a sheet of paper. Take a measure of 5 cm in the compasess. Place the pointed leg on P. Rotate the compasses. The point of the pencil draws the required circle.

## Exercise 5-6

1. Form the angles of the following measures through paper folding :

   (a) 75° (b) 135°.

2. Draw the line segment of the following lengths and bisect them through paper folding :

   (a) 7·5 cm (b) 8·3 cm.

3. Draw angles of the following measures and bisect them through paper folding :

   (a) 75° (b) 100° (c) 50° (d) 120°..

4. Draw a line. Mark a point P in the upper region and Q in in the lower region each at a distance of 4 cm. Through these two points draw lines parallel to the given line.

5. Draw a line. Draw three lines perpendicular to it.

6. Draw a circle of radius 5 cm.

7. Draw a circle of radius 7·2 cm.

# ANSWERS

## EXERCISE 5-1

1. (a) Sphere (b) cone (c) cuboid (d) Sphere
   (e) Cylinder (f) Cone (g) Cube (h) Cuboid
   (i) Sphere (j) Cylinder (k) Cone (l) Sphere
   (m) Cylinder.

2. (a) 6, 12, 8, (b) 6, 12, 8 (c) 4, 6, 4
   (d) 5, 8, 5 (e) 8, 18, 12 (f) 5, 9, 6
   Number of faces + Number of vertices − Number of edges = 2.

3. (a) Sphere (b) Cone (c) Cylinder (d) Hemisphere

4. (a) Rectangle (b) Square (c) Circle (d) Circle
   (e) Triangle (f) 4 (g) Hexagon.

## Exercise 5-2

1. (a) Innumerable points (b) Innumerable points
   (c) Innumerable points.

2. (a) 6 lines (b) 6 line segments.

3. (a) (i) 90 (ii) 30 (iii) 120 (iv) 60 (v) 150
   (b) (i) 90 (ii) 270 (iii) 45 (iv) 135 (v) 315 (vi) 360.

4. (a) 150 (b) 90 (c) 130 (d) 100 (e) 90

(f) ∠AOD, ∠BOD, ∠BOE (g) ∠AOB, ∠BOC, ∠COD ∠DOE, (h) ∠AOC, ∠COE.

## Exercise 5-3

1. Innumerable lines ; Innumerable curves.
2. Only one line ; Innumerable curves.
3. 3 lines ; Innumerable curves.
4. 6 lines ; Innumerable curves.
5. (ADF), (BCF), (ABE), (ECD).
6. Only one perpendicular line.
7. Perpendicular line.
8. One.
9. Innumerable parallel lines.
10. Yes, parallel lines.
11. A point.
12. Parallel lines.

## Exercise 5-4

1. Innumerable planes
2. Innumerable planes
3. Only one plane
4. Four planes
5. Innumerable planes
6. Only one plane
7. Only one plane
8. A line
9. A point
10. The line itself
11. Parallel
12. (AB, CG); (AB, DH); (AB, EH); (AB, FG) etc.

## Exercise 5·5

1. Not possible. 2. Not possible

3. (a) Not possible more than 180°

   (b) Not possible, less than 180°

   (c) possible; equal to 180°

   (d) possible; equal to 180°

   (e) possible; equal to 180°.

   (f) Not possible : more than 180°

4. (a) 70 (b) 50 (c) 20.

5. (a) Possible, (b), (c), (d) Possible (e), Not possible.

6. (a) acute, (b) obtuse, (c) right triangle
   (d) Isosceles right triangle.

7. (a) Yes (b) no (c) yes (d) no.

8. (a) 7 cm (b) 12 cm (c) 24 cm.

9. (a) 4 cm (b) 6 cm (c) 3·5 cm.

10. (a) One (b) Innumerable radii
    (c) Innumerable diameters (d) Innumerable chords.

# 6. APPLICATION

## 6-1. Ratios :

### 6-1. 1.

**B's house is twice farther away from the school as A's house is from the school. Using this statement answer the following questions:**

**Exercise 6-1**

1. Can you find the distance between A's house and the school ?
2. Can you find the distance between B's house and the school ?
3. If A's house is 10 m away from the school, how far is B's house from the school ?
4. The distance between A's house and the school is 3·5 m. Find the distance between B's house and the school.
5. The distance between B's house and the school is 40 m. Find the distance between A's house and the school.
6. The distance between B's house and the school is 16m. Find the distance between A's house and the school.

We see that we deal with two different distances in the above sums and we find a relation between them.

The comparison of two terms of the same denomination is called **ratio**. The symbol used to denote ratio is " : " (Read 'Is to'). In the above example, the ratio of the distance is 1 : 2 (read ' one is to two' ).

**Note :** The units of the terms must e of the same deno mination for comparison.

**The ratio can also be expressed as a fractional number.**

(e.g.) We can write 3:4 as $\frac{3}{4}$ and 7:10 as $\frac{7}{10}$. We can write the fraction in its simple form. Similarly the ratio can also be written in its simple form.

(e.g.) 10 : 20 = 1 : 2 ; 15 : 25 = 3 : 5 .

**6-1. 2. Comparison of ratios:**

(i) A ratio may be greater than another ratio.

(ii) A ratio may be equivalent to another ratio and

(iii) A ratio may be less than another ratio. We compare the ratios to find this out.

**Example 1 :** Which is greater? **5 : 6 ; 8 : 11 .**

5:6 and 8:11 may be written as $\frac{5}{6}$ and $\frac{8}{11}$ respectively

The l.c.m. of 6 and 11 is 66

$$\therefore \frac{5}{6} = \frac{5\times 11}{6\times 11} = \frac{55}{66}$$

$$\frac{8}{11} = \frac{8\times 6}{11\times 6} = \frac{48}{66}$$

$$\text{Since } \frac{55}{66} > \frac{48}{66}$$

$$\frac{5}{6} > \frac{8}{11}$$

Hence 5 : 6 is greater than 8 : 11.

**Example 2 :** A mason mixes cement and sand in the ratio 2:7. Another mason mixes them in the ratio 3:10. Which of the mixtures contains more sand?

First mixture — Cement : sand = 2 : 7

Second mixture — Cement : sand = 3 : 10

Since we have to compare the amount of sand in the mixtures, we make the quantity of cement equal in both mixtures.

The first mixture has 2 parts of cement and the second one 3 parts.

To equalise them, we find the l. c. m. of 2 and 3 i. e. 6.

$\therefore$ 2 : 7 = 6 : 21.

$\therefore$ 3 : 10 = 6 : 20.

$\therefore$ The first mixture contains more sand.

### 6-1. 3. Proportion :

#### Exercise 6-2

1. Find the ratio of : 10m to 20m.
2. Find the ratio of : 60m to 120m.
3. Compare the above two ratios. What do you find?

You know that 10 : 20 and 60 : 120 are equivalent. Therefore the ratios are said to be in **Proportion.**

A proportion has got four terms.

10 : 20 = 60 : 120. This is a proportion.

10 is the first term, 20 is the second term;

60 is the third term and 120 is the fourth.

The first and the fourth terms are called **the extremes or ends**: the second and the third terms are called the **middles or means.** In the above example, 10 and 120 are 'ends' and 20 and 60 are the 'means'.

### Exercise 6-3

1. **Complete the** table given below:

| | I Column | II Column | III Column | IV Column | I Col. × IV Col. | II Col × III Col. |
|---|---|---|---|---|---|---|
| a | 2 | 5 | 4 | 10 | — | — |
| b | 8 | 12 | 6 | 9 | — | — |
| c | 6 | 8 | 18 | 24 | — | — |
| d | 5 | 8 | 15 | 24 | — | — |
| e | 3 | 7 | 24 | 56 | — | — |

2. Find the ratio of each number of column I to that of column II.
3. Find the ratio of each number of column III to that of column IV.
4. Are the ratios obtained in Qn. 2 and Qn. 3 equivalent ?
5. Are the answers in each row of the columns 5 and 6 equal ?
6. What do you infer ?

**If the ratios are equivalent, the product of the extremes is equal to the product of the means.**

### 6-1. 4. Computation with ratios :

**Example 1 :** Distribute 30 mangoes between *A* and *B* in the ratio of 2 : 3.

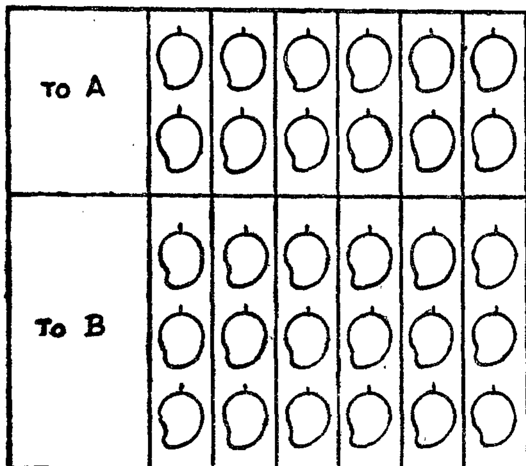



Fig. 6-1

If we give 2 mangoes to *A*, then *B* must get 3. For this we require 5 mangoes. In this way we can distribute 30 mangoes 6 times.

*A* gets $2 \times 6 = 12$ mangoes.

and *B* gets $3 \times 6 = 18$ mangoes.

This problem can be easily done in the following manner :

It '*A*' gets 2 parts then '*B*' will get 3 parts. Both of them together get 5 parts.

In other words, *A* gets $30 \times \frac{2}{5} = 12$ mangoes.

*B* gets $30 \times \frac{3}{5} = 18$ mangoes.

**Example 2:** Distribute Rs. 700 between *A* and *B* in the ratio of 3 : 4.

*A* gets 3parts and *B* gets 4 parts.

Total is 7 parts

*A* gets Rs. $\frac{3}{7} \times 700$ = Rs. 300.

*B* gets Rs. $\frac{4}{7} \times 700$ = Rs. 400.

**Example 3:** *A* sum is distributed between *A* and *B* in the ratio of 5 : 7. *A* gets Rs. 240. Find *B*'s share. What is the total amount?

*A* gets 5 parts.

The value of 5 parts = Rs. 240.

The value of 1 part = Rs. 240 ÷ 5 = Rs. 48.

*B* gets 7 parts = Rs. 48 × 7 = Rs. 336.

Total amount = Rs. 240 + Rs. 336.

= Rs. 576.

**Example: 4.** *A* and *B* share the fruits in a basket in the ratio of 7:10. *B* gets 15 fruits more than *A*. How many fruits are there in the basket?

*A*'s share is 7 parts.

*B*'s share is 10parts.

∴ *B* gets 3 parts more than *A*.

The value of 3 parts = 15 fruits.

The value of 1 part = $\frac{15}{3}$ or 5 fruits.

∴ *A*'s share = 7 × 5 or 35 fruits.

*A*'s share = 10 × 5 or 50 fruits.

∴ The total number of fruits = 85

**6-1. 5. Scale Drawings:**

The length of a garden is 50 m and breadth 20m. The picture of the garden cannot be drawn according to its actual size.

We draw a rectangle of 5cm × 2cm, so that it represents the garden. 1 cm in the picture represents 10 m. This is called the **scale of the drawing.** In other words 1cm actually represents $10 \times 100 = 1000$ cm. The ratio between the length in the picture and the actual length is 1 : 1000. This can also be written as $\frac{1}{1000}$. The ratio $\frac{1}{1000}$ is called the **representative fraction** of the drawing.

The size of the bacteria is very very small. The microscope makes it look bigger so that it can be seen. We say the microscope enlarges or magnifies the size of the bacteria. If the microscope magnifies the bacteria 1000 times, the representative fraction is $\frac{1000}{1}$ or scale is 1000 : 1. This means that the actual length of the bacteria is $\frac{1}{1000}$ of the corresponding length seen through the microscope.

## Exercise 6·4

1. A road of the length 300 m has been drawn to different scales by different students. If the length in the diagram is as follows, find the scale and the representative fraction used by each student.

   (a) 5 cm (b) 6 cm (c) 10 cm (d) 12 cm

   (e) 15 cm (f) 20 cm (g) 25 cm (h) 30 cm

2. In a picture, 1 cm actually represents 20 m. Give the distance represented by :

   (a) 5 cm (b) 2·5 cm (c) 12·8 cm

   (d) If the actual distance is 200 m. how will it be represented in the picture ?

3. In a scale drawing, 1 cm represents 20m. Find the length in the diagram which represents the actual distance of 170 m.

4. In a scale drawing 1 cm represents 20 m. Find the length of the diagram which represents the actual distance of 500 m.

## Exercise 6-5

1. Find the ratio of the shaded portion to the entire portion in the following figures.

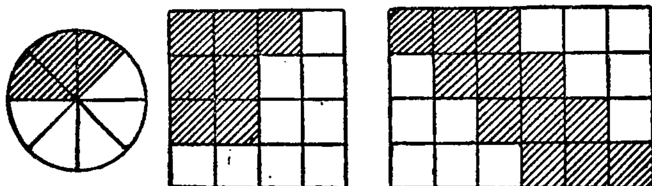


Fig. 6-2

2. Compare the following pairs of ratios :

(a) 6 : 17 ; 5 : 9 (b) 7 : 10 ; 3 : 4

(c) 5 : 17 : 3 : 11 (d) 8 : 25 ; 4 : 15

(e) 11 : 18 ; 7 : 12 (f) 16 : 11 ; 10 : 7

3. Find the term left out in the following :

(a) 3 : 5 = 18 : □ (b) 7 : 9 = □ : 27

(c) 4 : □ = 24 : 30 (d) □ : 3 = 21 : 9

(e) 5 : 7 = 20 : □ (f) 8 : 3 = □ : 12

(g) 15 : □ = 5 : 7 (h) □ : 33 = 16 : 11

4. (a) Distribute Rs. 400 between *A* and *B* in the ratio 3 : 5.

(b) Distribute 700 sq m. of land between *A* and *B* in the ratio of 17 : 18.

5. (a) Mani and Velu share an amount in the ratio of 10 : 7. Velu receives Rs. 15 less than Mani. Find their individual share. Find the amount.

(b) Ramu and Somu share a bag of paddy in the ratio of 11 : 5. Somu receives 36 l of paddy less than Ramu. How much each of them get ? Find the total quantity of paddy in the bag.

6. (a) Kuppan and Subban share an amount in the ratio of 11 : 9. If Kuppan gets Rs. 33, how much will Subban get ?

(b) $X$ and $Y$ share sweets in the ratio of 3 : 4. If $Y$ gets 12 sweets, how many sweets will $X$ get?

7. (a) A picture is drawn to the scale of 1 : 1000. Give the actual distance represented by (a) 1 cm (b) 3 cm in the picture.

(b) A picture is drawn to the scale of 1 : 10000. Give the actual distance represented by 1 cm in the picture.

8. (a) In a picture 1 cm actually represents 50 m. Find the representative fraction.

(b) In a picture 10 cm actually represents 1 mm. Find the representative fraction.

**6-1.6. Direct Variation :**

On 20-5-79 at 5 P. M. the shadow of 30 cm vertical rod is 90 cm long. The shadow of 10 cm vertical rod is 30 cm long.

Using the above data do the following Exercise.

**Exercise 6-6**

1. (i) Complete the table :

| | | | | | | |
|---|---|---|---|---|---|---|
| Height of the rods (in cms.) | 2 | 8 | 15 | | | |
| Length of the shadows (in cms.) | | | | 27 | 48 | 120 |

(ii) Find the ratio of any two rods.

(iii) Find the ratio of their respective shadows.

(iv) Are these two ratios equivalent ?

2. A book is priced at Rs. 5/- per copy.

(i) Complete the table :

| Number of books | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Total price (Rs.) | 5 | | | | | |

(ii) If the number of books is doubled, what happens to the price of the books ?

(iii) If the number of books is tribled, what happens to the price of the books ?

(iv) If the number of books is 4 times the original one, what happens to the price of the books ?

(v) Does the ratio of the books vary proportionately to the ratio of their respective prices ?

(vi) What do you learn ?

The price of books increases as the number of books increases.

Thus if two quantities vary in the same ratio, then theyare said to be in direct proportion

in the above table :

$$\frac{\text{Total price}}{\text{Number of copies}} = \frac{5}{1} = \frac{10}{2} = \frac{15}{3} = \frac{20}{4} \quad \frac{25}{5} = 5$$

Here, 5 is called the constant of variation.

**Price and quantity :**

**(e. g. 1)** The price of 7 Kg. of jaggery is Rs. 21. **What is the price of 10 Kg** of jaggery at the same rate ?

| Jaggery (Kgs.) | Price (Rs.) |
|---|---|
| 7 | 21 |
| 10 | ? |

The cost of jaggery increases proportionately as the quantity of jaggery increases. Therefore the cost of jaggery varies directly as the quantity of jaggery.

When the quantity increases in the ratio 10 : 7, the cost also increases in the ratio 10 : 7; that is, the cost of 10 Kg becomes $\frac{10}{7}$ times the cost of 7 Kg.

$\therefore$ The cost of 10 Kg of jaggery = Rs. $\frac{10}{7} \times 21$ = Rs. 30.

**Verification :**

The cost of 7 Kg jaggery is Rs. 21

The cost of 1 Kg jaggery is Rs. $\frac{21}{7}$ = Rs. 3

$\therefore$ The cost of 10 Kg of jaggery is Rs. $3 \times 10$ = Rs. 30.

**Time and Work :**

**(e. g. 2)** In 8 minutes 56 litres of water flows through a tap. How many litres of water will flow through that tap in 15 minutes.

| Time (minutes) | Water (litres) |
|---|---|
| 8 | 56 |
| 15 | ? |

The quantity of water increases proportionately as the duration of waterflow increases. So the quantity of water varies directly as the time.

The duration of water flow becomes $\frac{15}{8}$ times.

$\therefore$ The quantity of water $= \frac{15}{8} \times 56$ l $= 105$ l.

**Verification :**

In 8 minutes the quantity of water available is 56 litres.

In 1 minute the quantity of water available is $\frac{56}{8}$ l $= 7$ litres.

In 15 minutes the quantity of water available is $7 \times 15 = 105$ litres.

**Time and Distance :**

(e. g. 3) At a uniform speed Kandan Cycles 15 km in 3 hours. How many kilometres would he have travelled at the same speed in 5 hours?

| Time (hours) | Distance (kms) |
|---|---|
| 3 | 15 |
| 5 | ? |

The distance travelled increases proportionately as the time increases. So time and distance are in direct proportion.

When the time becomes $\frac{5}{3}$ times, the distance travelled also becomes $\frac{5}{3}$ times.

$\therefore$ In 5 hours of time Kandan would have travelled $\frac{5}{3} \times 15$ km $= 25$ km.

**Principal and Simple Interest :**

(e. g. 4) : The interest charged for a sum of Rs. 700 is Rs. 84. Find the interest that will be charged for Rs. 1200 for the same period at the same rate.

| Principal (Rs.) | Interest (Rs.) |
|---|---|
| 700 | 84 |
| 1200 | ? |

As the principal increases, the amount of interest increases in direct proportion.

When the principal becomes $\frac{1200}{700}$ times, the interest also becomes $\frac{1200}{700}$ times

Interest for Rs. 1200 = $\frac{1200}{700} \times 84$ = **Rs. 144**

## Exercise 6-7

1. (a) The cost of 6 time-pieces is Rs. 390. Find the cost of 9 time-pieces.

   (b) The cost of 8 m shirting cloth is Rs. 68. Find the cost of 6 m of the same.

   (c) Kandan paid Rs. 12-50 for 5 litre of milk. How much Velan has to pay for 8 litre of milk at the same rate ?

   (d) Balan's family requires 7 kg of sugar a month. It costs Rs. 21. Velan's family requires 12 kg of sugar a month. What will be its cost at the same rate ?

2. (a) 12 men can construct a road of 120 sq. m. What will be the area of road constructed by 20 men of the same skill?

   (b) Raman can paint 15 boxes in 5 hours. How many boxes can be painted by him in 6 hours?

   (c) A typist can type 200 words in 5 minutes. How many words can be typed in 12 minutes taking that he does it at a uniform speed?

   (d) 35 litre of water can flow through a tap in 7 minutes. How many litres of water can you tap in 15 minutes?

3. (a) Rajagopalan travels 12 km in a bullock-cart in 3 hours. How long would he have travelled at the same speed in 5 hours?

(b) Gopalan cycled 30 km in 5 hours. How long will he take to travel 21 km?

(c) The wheel of a machine makes 120 revolutions in 5minutes. How many revolutions will it make in 8 minutes at the same speed ?

(d) A man travelled 300 km in 6 hours. How many hours would he take to travel 275 km?

4 (a) The annual interest charged for Rs. 4,000 is Rs. 720. Find the annual interest for Rs. 3,200.

(b) The interest for a certain principal for 3 years is Rs. 141. Find the amount of interest at the same rate and for the same principal for 7 years.

(c) A certain principal yields an interest of Rs. 54 in 3years. How long shall the principal be deposited to yield an interest of Rs. 126.

(d) If a principal of Rs. 5,000 yields an interest of Rs. 75 a month, how much one should invest to get an interest of Rs. 120 a month?

5 State whether the following statements are true or false,

(a) The age of a man varies directly as his height.

(b) The age of a man varies directly as his weight.

(c) The number of 40 w bulbs available varies directly as its price.

(d) The revolutions of a wheel varies directly as the distance travelled.

(c) The time taken to dry a wet cloth varies directly as its length.

## 6·2. Percentages :

Percentage is a fractional number. If the denominator of a fractional number is 100, then the fractional number represents a percentage. Percentage is denoted by "%". The word percentage means "for every hundred" or hundredths of a given number. Percentage is a ratio whose second term is 100. 3 out of 5 is written as $\frac{3}{5}$. $\frac{3}{5}$ can be written as $\frac{3 \times 20}{5 \times 20} = \frac{60}{100}$

$\frac{60}{100}$ is actually 60 out of 100 or 60%.

**Note :** 60% means $\frac{60}{100}$. So also 100% means $\frac{100}{100}$. A fractional number can be expressed as a percentage and vice versa.

To convert a fractional number into a percentage, that fractional number should be multiplied by $\frac{100}{100}$ i. e. 100%.

(e. g.) $\frac{5}{8} = \frac{5}{8} \times 100\% = \frac{500}{8}\% = 62\frac{4}{8}\% = 62\frac{1}{2}\%$

**To convert a percentage into a fractional number the amount of percentage should be divided by 100.**

The symbol % stands for $\frac{1}{100}$.

(e.g.) $50\% = \frac{50}{100} = \frac{1 \times 50}{2 \times 50} = \frac{1}{2}$

**A percentage can also be expressed as a decimal fraction :**

$38\% = \frac{38}{100} = \frac{30}{100} + \frac{8}{100} = 0.38$

**A decimal fraction can also be expressed as a percentage.**

(e.g.) Express 0.54 as a percentage.

$0.54 = 0.54 \times 100\% = 54\%$

Percentages are applicable in several life situations.

*(a)* It is easy to compare two fractional numbers if they are expressed as percentages.

*(e.g.)* Compare $\frac{3}{5}$ and $\frac{9}{16}$ by changing them into percentages.

$\frac{3}{5} = \frac{3}{5} \times 100\% = \frac{300}{5}\% = 60\%$

$\frac{9}{16} = \frac{9}{16} \times 100\% = \frac{900}{16} = 56\frac{4}{16}\% = 56\frac{1}{4}\%$

$\therefore \frac{3}{5} > \frac{9}{16}.$

(b) Percentages are used to compare the marks, to calculate profit and loss, interest etc.

*(e.g.)* Valli scored 9 out of 20 marks in the first test and 12 out of 25 marks in the second test. When did she get more marks?

In the first test, Valli obtained $\frac{9}{20} = \frac{9}{20} \times 100\% = 45\%$

In the second test, Valli obtained $\frac{12}{25} = \frac{12}{25} \times 100\% = 48\%$

So Valli got more marks in the second test.

Some fractional numbers and their equivalent percentages are given below. Learn them.

| | |
|---|---|
| $\frac{1}{2} = 50\%$ | $\frac{1}{5} = 20\%$ |
| $\frac{1}{4} = 25\%$ | $\frac{2}{5} = 40\%$ |
| $\frac{3}{4} = 75\%$ | $\frac{3}{5} = 60\%$ |
| $\frac{1}{8} = 12\frac{1}{2}\%$ | $\frac{1}{3} = 33\frac{1}{3}\%$ |
| $\frac{1}{16} = 6\frac{1}{4}\%$ | $\frac{2}{3} = 66\frac{2}{3}\%$ |
| $\frac{1}{10} = 10\%$ | $\frac{1}{6} = 16\frac{2}{3}\%$ |
| $\frac{1}{20} = 5\%$ | $\frac{1}{12} = 8\frac{1}{3}\%$ |
| $\frac{1}{40} = 2\frac{1}{2}\%$ | |

## Exercise 6-8

1. Express as percentage:

   (a) $\frac{3}{8}$ (b) $\frac{7}{16}$ (c) $\frac{13}{20}$ (d) $\frac{9}{18}$ (e) $\frac{4}{5}$ (f) $\frac{1}{15}$.

2. Express as fractional number:

   (a) 8% (b) 45% (c) 75% (d) 60% (e) 32% (f) 49%

3. Express as decimal fraction:

   (a) 72% (b) 8% (c) 10% (d) 17% (e) 50% (f) 75%

4. Express as percentage:

   (a) $0\cdot\dot{2}$ (b) $0\cdot\dot{7}2$ (c) 0·07 (d) 0·125 (e) 0·4 (f) 0·08.

5. In an examination a student scored 28 out of 50 in Mathematics and 11 out of 20 in Tamil. In which subject did he score more marks?

6. In a heap of 1,500 fruits, 300 fruits perished. Find the percentage of the fruits in good condition.

7. My monthly income is Rs. 800. I spend Rs. 584 on food. Find the percentage of my income spent on food.

8. Express as percentages:

   (a) 300gm out of 1 kg.
   (b) 15 minutes out of 1 hour.
   (c) 100ml out of 1 litre.
   (d) 50m out of 1km.
   (e) 40 paise out 1 Re.

**Some applications:**

(e. g. 1) Last year the price of a machine was Rs. 8,400. If there is an increase of 7% in the price, find the current price.

Last year the price of the machine was Rs. 8,400.

In the current year there is an increase of 7%

$\therefore$ The amount of price increase = Rs. 8,400 $\times \frac{7}{100}$
= **Rs. 588**

The current price Rs. 8,400 + Rs. 588.
= Rs. 8,988

**Note:** The current price is also 107% of the old price and is equal to Rs $\frac{107}{100} \times 8400$ = Rs. 8,988

**(e. g. 2)** Last year the population of a village was 18,000. In the current year there is a 5% decrease. Find the present population.

Last year the population was 18,000

In the current year there is a decrease of 5%

$\therefore$ The amount of decrease = $18000 \times \frac{5}{100} = 900$

Present population = 18000—900
= 17,100.

**Note:** The present population is (100—5)% of the present population and is equal to $\frac{95}{100} \times 18,000 = 17,100$

**Business problem:**

In business, the profit or lossis expressed as a percentage of the price

(e.g. 3) Sridharamoorthi bought a certain article at Rs. 80 and sold it at Rs. 92. Find the percentage of profit.

Profit = selling price — cost price.
= Rs. 92 − Rs. 80 = Rs 12.

For a cost price of Rs. 80 the profit is Rs. 12.

$\therefore$ Percentage of profit is $\frac{12}{80} \times 100\% = 15\%$.

**(e.g. 4)** A pen is bought for Rs. 10 and sold at Rs. 8. Find the percentage of loss.

Cost price = Rs. 10. Selling price = Rs. 8.

For a cost price of Rs. 10, the loss is Rs. 2.

$\therefore$ percentage of loss is $\frac{2}{10} \times 100 = 20\%$.

(e.g.5) A man purchased a table for Rs. 150. He sold it at a profit of 6%. Find the sale price.

Cost price = Rs. 150.

Selling price is 106% of the cost price

$\therefore$ Selling price = Rs. $150 \times \frac{106}{100}$ = **Rs. 159.**

(e.g.6) A motor car was bought for Rs. 12,000. He sold it at a loss of 3%. Find the selling price.

Cost price = Rs. 12,000.

Selling price is 97% of the cost price.

$\therefore$ Selling price = Rs. $12000 \times \frac{97}{100}$ = **Rs. 11,640.**

**Simple interest :**

You have learnt already that the formula for finding simple interest is:

I = PNi (I – Simple interest, P—Principal, N—Time in years, i—rate percent).

Amount = Principal + Interest.

(e.g.7) Find the simple interest at the rate of 6% for Rs. 400, for 3 years. Find the amount.

P = Rs. 400, N = 3 years, $i = \frac{6}{100} = 0{\cdot}06$

Simple interest = Rs. $400 \times 3 \times {\cdot}06$

= Rs. 72.

Amount = Rs. 400 + 72 = Rs. 472.

(e.g.8) Find the simple interest for Rs. 2,190 at the rate of 12% per year, for the period from 8-10-78 to 17-2-79. Find also the amount.

From 8-10-78 to 17-2-72 the number of days is

| | | | | |
|---|---|---|---|---|
| October | 1978 | — | 24 | [inclusive of 8th] |
| November | | — | 30 | |
| December | | — | 31 | |
| January | 1979 | — | 31 | |
| February | | — | 16 | [exclusive of 17th] |
| Total Number of days | | | 132 | |

$P = \text{Rs. } 2190$, $N = \frac{132}{365}$ year, $i = 12\% = 0.12$

Simple interest $= \text{Rs. } 2190 \times \frac{132}{365} \times 0.12$

$= \text{Rs. } 95.04.$

Amount $= \text{Rs. } 2190 + \text{Rs. } 95.04.$

$= \text{Rs. } 2285.04.$

**Important note:** Interest is charged for the date of deposit of taking the loan, but is not charged for the date of withdrawal or repayment.

**Exercise 6-9**

1. (a) On 7-8-79 in 8th standard A, 32 out of 40 students attended the school. In 8th standard B 43 out of 50 students attended the school. Which division has the better percentage of attendance?

   (b) While making jewels a goldsmith mixed 2 parts copper with 22 parts of gold. Another goldsmith mixed 1 part of copper with 10 parts of gold. Which jewel contained more of copper ?

   (c) In an election 2,200 men out of 2500 men had voted. 3,200 women out 4,000 women had voted. Who had the greater percentage of voting?

2. (a) Last year the price of a land was Rs. 18,500. This year there is an increase of 5%. What is the current price of the land?

   (b) Last month the cost of a radio set was Rs 850. Now there is an increase of 8%. Find its current price.

   (c) In 1961, the population of a village was 27,000. In 1971 there was an increase of 6% in that population. What was the population of that village in 1971.

3. (a) In a hospital, there were 21,500 out-patients in the month of August. In the month of September there was a decrease of 2%. How many patients were there in the month of September?

(b) On the first day of a month things worth Rs. 300 were sold in a shop. On the 15th day of the month there was a decrease of 15% in the sales. Find the sales on the 15th day.

(c) In the quarterly examination Hari scored a total of 420. In the half-yearly examination there was a decrease of 10% in the total. Find his total marks in the half-yearly examination.

4. (a) A man bought a machine for Rs. 1,650 and sold the same at Rs. 1,875. Find the percentage of gain.

(b) A man buys one dozen pens at the rate of Rs. 5 each, and sells them at Rs. 6 each. Find the percentage of profit.

(c) A man purchased a bag of rice containing 70kg. for Rs. 175. He sold it at Rs. 2.75 per Kilo. Find the percentage of profit.

5. (a) A man buys one dozen fruits for Rs. 18, and sells it at Rs. 1-25 each. Find the percentage of loss.

(b) A man purchased a house for Rs. 35,000. Find the percentage of loss if he sold the same reducing its price by Rs. 3,000.

(c) A man invested Rs. 10,000 in a business. There was a loss of Rs. 2,000. Find the percentage of loss.

6. (a) A man purchased a grinder for Rs. 1,750. He sold the same at a profit of 5%. Find the sale price.

(b) A man bought one hundred fruits for Rs. 35. He sold them at a profit of 12%. Find the sale price.

(c) A man bought a Murrah buffalow for Rs. 3000 and sold it at a profit of 4%. Find the sale price.

7. (a) A man buys a bicycle for Rs. 600 and sells the same at a loss of 5%. Find the sale price

(b) A vegetable vendor buys some vegetables for Rs. 20 and sells them at a loss of 2%. Find the sale price.

(c) The cost price of a steel table is Rs. 1200. He sold it at a loss of 8%. Find its sale price.

8. (a) Find the simple interest for Rs. 1750 for 4 years at the rate of 12% per annum. Find also the amount due at the end of the term.

(b) Find the simple interest for Rs. 5,000 for 3 years at the rate of 15% per year. Find also the amount due after 3 years.

(c) Find the simple interest for Rs. 2,500 for 4 years at the rate of $12\frac{1}{2}$% per year. Find also the amount.

9. (a) Find the simple interest and amount due for Rs. 1,200 at the rate of 15% per annum for the period from 15-7-77 to 8-12-77.

(b) Find the simple interst and amount due for Rs. 730 at the rate of 18% per annum for the period from 1-9-1978 to 15-3-1979.

(c) Find the simple interest amount due for Rs. 7,500 at the rate of 15% per year, for the period from 1-1-78 to 20-10-78.

### 6-3. Inverse variation

**Applications:**

Taking that a basket contains 24 fruits, do the following exercise.

### Exercise 6-10

1. These fruits were distributed equally among 24 persons Find the number of fruits each got.
2. They were distributed equally among 12 persons. Find the number of frutits go by each.

3. If these fruits were distributed equally among 8persons, find the number of fruits got by each.

4. If these fruits were distributed equally among 6 persons, find the number of fruits got by each.

5. If these fruits were distributed equally among 4 persons, find the number of fruits got by each.

6. If these fruits were distributed equally among 3 persons, find the number of fruits got by each.

7. If these fruits were distributed equally between 2 persons, find the number of fruits got by each.

8. These fruits were given to only one person. How many fruits did he get?

9. Using the above, complete the following table.

| Name of persons | 24 | 12 | 8 | 6 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| Number of fruits got by each | | | | | | | | |

10. If the ratio of the persons is 24 : 12, find the ratio of the number of fruits they get. Does it vary directly?

11. If the ratio of the persons is 12 : 8, find the ratio of the number of fruits they get. Does it vary directly?

12. What do you infer from these data?

From the table, we discover that as the number of persons becomes 2,3,4 times the number of fruits they are getting becomes $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$, of the total respectively. That is, as the number of persons increase, the amount of their share decreases. If the ratio of the number of persons is 24 : 12, the ratio of the number of fruits will be 12 : 24 which is the inverse of 24 : 12.

It two quantities vary in the inverse ratio, the two quantities are said to be in **inverse proportion** of each other.

Further in the table, find the product of the two quantities, namely, the number of persons and the number of fruits they get at each sharing.

$24 \times 1 = 12 \times 2 = 4 \times 6 = 3 \times 8 = 24$. Here 24 is called the Constant of proportionality.

Thus **the product of the measures of two quantities in inverse variation is constant.**

**Men and Days:**

(e.g. 1) 4 men can whitewash a building in 12 days. Find the number of days required by 6 men to whitewash the building.

| Men | Days |
|---|---|
| 4 | 12 |
| 6 | ? |

More the men, less the number of days to complete the work. That is, the number of men and the days vary inversely. When the number of men becomes $\frac{6}{4}$ times, the number of days becomes $\frac{4}{6}$ times.

$\therefore$ Number of days $= \frac{4}{6} \times 12 = 8$.

**Verification:** 4 Men can finish the work in 12days. 1 man can finish it in $12 \times 4 = 48$ days.

6 men can finish it in $\dfrac{12 \times 4}{6} = 8$ days.

(e.g. 2) In a hostel, there is sufficient quantity of rice for 50 students for 30 days 10 more students join them. Find for how many days the rice will be sufficient.

| Students | Days |
|---|---|
| 50 | 30 |
| 60 | ? |

When the quantity of rice is constant, the number of students and number of days vary inversely as each other.

When the number of students becomes $\frac{60}{50}$ times, the number of days becomes $\frac{50}{60}$ times

$\therefore$ No.of days $= \frac{50}{60} \times 30 = 25$.

**Verification:**

For 50 students food is sufficient for 30 days.

For 1 student food is sufficient for $50 \times 30$ days.

For 60 students food is sufficient for $\frac{50 \times 30}{60} = 25$ days

**Time and distance :**

*(e. g. 3)* It takes 5hours for a man to reach a place at a speed of 15km/h. What time will he take if he travels at 10km/h to reach the same place?

| Speed (km) | Time (hours) |
|---|---|
| 15 | 5 |
| 10 | ? |

When the distance is constant the speed and time vary inversely. When the speed becomes $\frac{10}{15}$ times, the time becomes $\frac{15}{10}$ times.

$\therefore$ Time $= \frac{15}{10} \times 5 = 7\frac{1}{2}$ hours.

**Verification :**

If he travels at a speed of 15 km/h for 5 hours, the distance travelled $= 15 \times 5 = 75$km.

If he travels at a speed of 10 km/h it will take $\frac{75}{10} = 7\frac{1}{2}$ hours.

**Quantity and cost :**

*(e.g.4)* A man buys 30 pens at the rate of Rs. 5 per pen. If he buys for the same amount a different kind of pen at the rate of Rs. 6 a pen, find the number of pens he can buy.

| Cost of pen (Rs.) | Number of pens |
|---|---|
| 5 | 30 |
| 6 | ? |

When the amount is constant, the ratio of the cost of a pen and the number of pens vary inversely.

Here the price becomes $\frac{6}{5}$ times, the number of pens becomes $\frac{5}{6}$ times.

$\therefore$ If the price of a pen is Rs. 6 number of pens $= \frac{5}{6} \times 30 = 25$.

**Verification :**

If the price of a pen is Rs. 5, the cost of 30 pens is Rs. $5 \times 30 =$ Rs. 150.

For Rs. 6 he can buy 1 pen.

For Rs. 150 he can buy $\frac{1}{6} \times 150 = 25$.

**Exercise 6-11**

1 (a) 24 men can do a work in 15 days. How many days will 20 men take to complete the same work?

(b) 4 men can unload a cart in 3 hours. How many hours will 2 men take to unload the same cart?

(c) 5 pipes of the same size fill a trough in 8 hours. How many hours will 4 pipes of the same size take to fill the same trough?

2. (a) A car takes 5 hours to reach a place at a speed of 60 km/h. What time will it take, if it travels at 50 km/h?

(b) A typist types 40 words per minute. He takes 30 minutes to type a document. If he types 25 words per minute, how many minutes will he take to type the same document?

3. (a) A man bought 7 umbrellas at the rate of Rs. 25 each. How many umbrellas can he buy for the same amount if the price of an umbrella is Rs 35 ?

(b) A man bought 70 kg of sugar at the rate of Rs. 2-25 per kg. How much sugar can he buy for the same amount, if the price of it is Rs 2-50 per kg?

(c) A man bought 20 mirrors at the rate of Rs. 15 a mirror. How many mirrors can he buy for the same amount, if the price of a mirror is Rs. 25 ?

## 6-4. Average :

A cricket player scores 10,20,35,45,50 runs respectively in 5 innings. Answer the following questions :

1. What is the total number of runs scored by him ?
2. How many innings did he play ?
3. Divide the total runs scored by the total number of innings?
4. Had he scored equal runs in each of the 5 innings, what would have been the score in one innings ?
5. See whether the answers of Qn.3 and Qn.4 are equal.

From the above discussion, we can see that he had scored a total of 160 runs in five innings. Had he scored equal runs in each of the innings, he would have scored 32 runs. We say his **average** is 32 runs.

$$\text{Average} = \frac{\text{Total run scored}}{\text{innings played}}$$

In the above example the greatest score is 50 and the least score 10. His average score is 32.

The average lies between the greatest score and the least score.

You will find that **the average of several measures always lies between the greatest and the least of those measures.**

(e. g. 1) The marks scored by a student in 6 tests are 30,38,26.48,22,34 respectively. Find his average marks.

The total marks scored by him in 6 tests = 30 + 38 + 26 + 48 + 22 + 34 = 198.

His average marks = $\frac{198}{6}$ = 33

(e. g. 2) The average weight of a class of 50 students is 32 kg. Find the total weight of all the students.

The average weight of 50 students = 32 kg

∴ The total weight of 50 students = $32 \times 50$ kg = 1,600 kg.

**(e. g. 3)** In a grocer's shop, the average daily sale for the first 10 days of the month of September was Rs. 330. For the remaining 20 days, the average daily sale was Rs. 180. Find the average daily sale for that month.

Average daily sale for the first 10 days = Rs. 330

∴ Total sale for the first 10 days = Rs. $330 \times 10$ = Rs. 3300

Average daily sale for the remaining 20 days = Rs. 180.

∴ Total sale for remaining 20 days = Rs $180 \times 20$
= Rs 3600

∴ Total sale for 30 days = Rs 3300 + Rs 3600
Rs. 6,900.

∴ Average daily sale for the month of September = Rs. $\frac{6900}{30}$
= Rs. 230.

## Exercise 6-12

1. Find the average of 17, 25, 38, 41, 59

2. The collections on 7 days for a drama are as follows :
Rs. 753, Rs. 680, Rs. 552, Rs. 714, Rs. 580, Rs 1020 and Rs. 895. What is the average daily collection ?

3. The weights of rice in six bags of rice are as follows (In kg) /
70, 72, 75, 71, 68, 64. Find the average weight of a bag of rice.

4. The average strength of 6 classes is 38. Find the total number of students.

5. The average price of 15 tables is 210. Find the total price of 15 tables.

6. The average weight of 25 students is 35 kg. Find their total weight.

7. In a class, the average height of 14 pupils is 135 cm; the average height of the remaining 16 pupils is 145 cm. Find the average height of the class.

8. A man travels for 3 hours at a speed of 45 km/h and again he travels for 2 hours at a speed of 55 km/h. Find the average speed.

9. Three groups boarded a boat. The average weight of the 10 members of the first group is 30 kg. The average weight of the 4 members of the second group is 35 kg. The average weight of the 6 members of third group is 40 kg. Find the average weight of those in the boat.

10. In a week, the aveage temperature of a place is 33°C. The average temperature of the first 5 days is 32°C. Find the average temperature of the rest of the days.

### 6·5. Shopping Problems :

We purchase our requirements from the shop. The shopman gives a bill nd takes money from us. The bill contains the quantity of the articles purchased, the rate, the cost etc.

**Model of a bill :**

| No. | Quantity | Details | Rate | Price |
|---|---|---|---|---|
| | | | | |
| | | | Total cost | |

For some articles, Sales Tax is charged on the total cost at the rate of so many paise ( i.e. 2 ps, 3 ps. etc.) per rupee. Government fixes the rate of S. T. In the following sum. S T. is not shown separately.

(e. g.) Prepare a bill :

4 kg sugar at Rs. 3-10 per kg.

3 kg coffee seeds at Rs. 12-50 per kg.

6 Soap cakes at Rs. 2-75 per cake.

5 packets of Asafoetida at 1-60 per packet.

| No. | Quantity | Details | Rate Rs. Ps. | Cost Rs. Ps. |
|---|---|---|---|---|
| 1 | 4 kg | Sugar | 1 kg 3-10 | 12-40 |
| 2 | 3 kg | Coffee Seeds | 1 kg 12-50 | 37-50 |
| 3 | 6 cakes | Soap | Each 2-75 | 16-50 |
| 4 | 5 packets | Asafoetida | 1 pkt 1-60 | 8-00 |
| | | | Total cost | 74-40 |

**Exercise 6-13**

Prepare a bill :

1. 2 metres shirting cloth at Rs. 8-50 per metre.
   3 metre skirt cloth at Rs. 12-25 per metre.
   4 metre pant cloth at Rs. 15. per metre.
   3 banians at Rs. 6-75 each.

2. 4 kg of Bengal gram at Rs. 5-30 per kg.
   2 kg of Black gram at Rs. 4-80 per kg.
   5 kg sugar at Rs. 3-10 per kg.
   15 kg Rice at Rs. 2-70 per kg.

3. 1 dozen pencils at 35 ps. each.
   $\frac{1}{2}$ dozen pens at Rs. 2-50 each.
   1 dozen notebooks at 30 ps. each.
   5 Quires paper at Rs. 1-80 per Quire.
   1 dozen Rubber pieces at 25 ps. each.

4. 500 gm tamarind at Rs. 6-20 per kg.
   250 gm chillies at Rs. 7-00 per kg.
   250 gm corriander at Rs. 5-20 per kg.
   4 packets Tea at 20 p. per packet.

5. 24 notebooks of 40 pages at 25 ps. each.
   18 notebooks of 80 pages at 40 ps. each.
   16 notebooks of 100 pages at 65 ps. each.
   14 notebooks of 200 pages at Rs. 1-15 each.
   12 notebooks of 300 pages at Rs. 1-75 each.

## Answers

### Exercise 6—4

1. (a) 1 cm = 60 m; 1 : 6000
   (b) 1 cm = 50 m; 1 : 5000
   (c) 1 cm = 30 m; 1 : 3000
   (d) 1 cm = 25 m; 1 : 2500
   (e) 1 cm = 20 m: 1 : 2000
   (f) 1 cm = 15 m, 1 : 1500
   (g) 1 cm = 12 m; 1 : 1200
   (h) 1 cm = 10 m; 1 : 1000
2. (a) 100 m (b) 50 m (c) 256 m (d) 10 cm.
3 8·5 cm 4. 25 cm.

### Exercise 6—5

1. (a) 3 : 8 (b) 7 · 16 (c) 13 : 24.
2. (a) 5 : 9 (b) 3 : 4 (c) 5 : 17 (d) 8 : 25 (e) 11 : 18
   (f) 16 : 11 These are bigger ratios.
3. (a) 30 (b) 21 (c) 5 (d) 7
   (e) 28 (f) 32 (g) 21 (h) 48.

4. (a) Rs. 150, Rs. 250 (b) 340 sq. m, 360 sq. m

5. (a) Rs. 50 ; Rs. 35 ; Total Rs. 85

(b) 66 litre; 30 litre; Total 96 litre

6. (a) Rs. 27 (b) 9 sweets

7. (a) 10 m. 30 m (b) 100 m

8. (a) 1 : 5000 (b) 100 : 1.

## Exercise 6-7

1. (a) Rs. 585 (b) Rs. 51 (c) Rs. 20 (d) Rs. 36

2. (a) 200 sq. m (b) 18 boxes (c) 480 words (d) 75 litre.

3. (a) 20 km (b) 3 hrs 30 minutes (c) 192 revolutions
   (d) 5 hrs 30 minutes.

4. (a) Rs. 576 (b) Rs. 329 (c) 7 years (d) Rs. 8,000.

5. (a) False (b) False (c) True (d) True (e) False.

## Exercise 6-8

1. (a) $37\frac{1}{2}\%$ (b) $43\frac{3}{4}\%$ (c) 65% (d) $56\frac{1}{4}\%$ (e) 125%
   (f) $58\frac{1}{3}\%$.

2. (a) $\frac{2}{25}$ (b) $\frac{9}{20}$ (c) $\frac{3}{4}$ (d) $\frac{3}{5}$ (e) $\frac{8}{25}$ (f) $\frac{49}{100}$.

3. (a) ·72 (b) ·08 (c) ·1 (b) ·17 (e) ·5 (f) ·75

4. (a) 20% (b) 72% (c) 7% (d) 12·5% (e) 40% (f) 8%.

5. Maths 6. 80% 7. 73%

8. (a) 30% (b) 25% (c) 10% (d) 5% (e) 40%.

## Exercise 6-9

1. (a) B (b) II goldsmith (c) men.

2. (a) Rs. 19,425 (b) Rs. 918 (c) 28,620.

3. (a) 21,070 (b) Rs. 255 (c) 378.

4. (a) $13\frac{7}{11}\%$ (b) 20% (c) 10%.

5. (a) $16\frac{2}{3}\%$ (b) $8\frac{4}{7}\%$ (c) 20%.

6. (a) Rs. 1837.50 (b) Rs. 39-20 (c) Rs 3120.

7. (a) Rs. 570 (b) Rs. 19-60 (c) Rs. 1,104.

8. (a) Rs. 840; Rs. 2,590 (b) Rs. 2,250; Rs. 7,250.
(c) Rs. 1,250; Rs. 3,750.

9. Rs. 1,272 (b) Rs. 70-20; Rs. 800-20
(c) Rs. 900; Rs. 8,400.

## Exercise 6-11

1. (a) 18 days (b) 3 hours (c) 10 hours.

2. (a) 6 hours (b) 48 minutes.

3. (a) 5 umbrellas (b) 63 kg (c) 12 mirrors.

## Exercise 6-12

1. 36 (2) Rs. 742 (3) 70kg (4) 228 persons

5. Rs. 3150 (6) 875kg (7) 140.33 cm (Approximately)

8. 49 km (9) 34 kg (10) 35.5°C.

## Exercise 6-13

1. Rs. 134 2. Rs. 86-80 3. Rs. 34-80

4. Rs. 6-95 5. Rs. 60-70.

# 7. GRAPHS

## 7-1. One dimentional graphs :

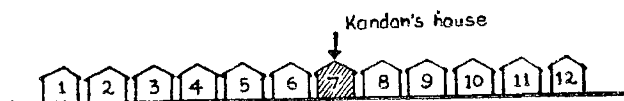



Fig. 7-1

The figure above illustrates the street where Kandan lives His door number is 7. In the figure the shadowed one is his house.

If we want to show the houses whose numbers are less than 7, we have to shadow the houses with numbers 1, 2, 3, 4, 5, and 6 Do this in your graph notebook with red colour.

Similarly to show the house whose numbers are greater than 7, we have to shadow the houses with numbers 8,9,10,11 and 12.

Do this in your graph notebook with green colour

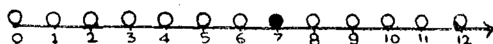



Fig. 7-2

In the above figure the dot which represents 7 is shown by a thick dot.

### Exercise 7-1

In your graph notebook draw six such figures. Do the following exercise. Use different colours each time.

1. Mark the numbers less than 7 with thick dots.
2. Mark the numbers greater than 7 with thick dots.

3. Mark the odd numbers with thick dots.

4. Mark the even numbers with thick dots.

5. Mark the numbers between 6 and 11.

6. Mark the prime numbers which are less than 12 with thick dots.

We find the graph above is a number ray with certain data described.

Draw a number ray as shown below with hollow dots to represent whole numbers.

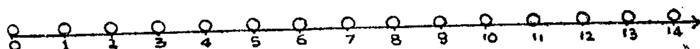



Fig. 7-3

**Example**: Find the solution, in whole numbers for the following :

(i) $X=5$ (ii) $X>5$ (iii) $X<5$

(i) Equation $X=5$

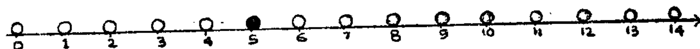



**Fig. 7-4**

We have to point 5 on the number ray. So it is shown by shadowing.

(ii) $X>5$ (In equality)

We know to show all numbers greater than 5, we shadow all hollow dots representing 6, 7, 8, 9, 10 and so on.




Fig. **7-5**

(iii) $X<5$ (In equality).

We have to show the numbers smaller than 5. We shadow the hollow dots standing for 4, 3, 2, 1 and 0.




Fig. 7-6

## Exercise 7-2

1. Draw the following exercise in your graph notebook. (whole numbers).

   (a) X=4 (b) X>8 (c) X<7

   (d) X=10 (e) X>8 (f) X<12

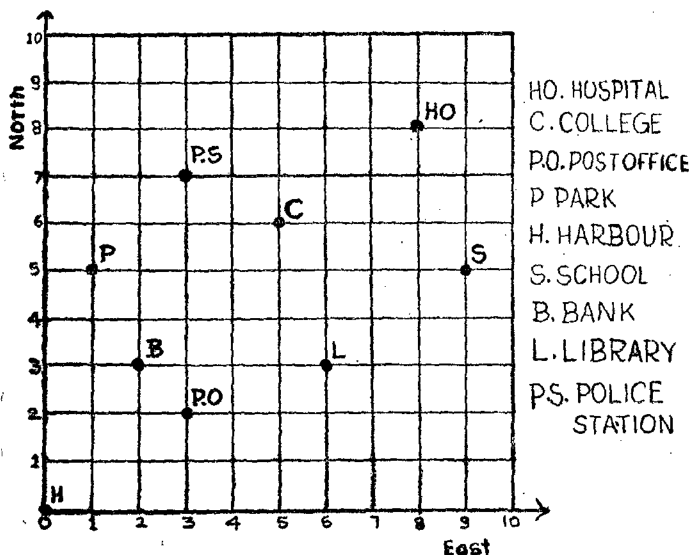



Fig. 7-7

In the above graph sheet there are 11 horizontal lines, and 11 verticle lines. In this graph, the school is situated at the intersection of the 9th vertical line and 5th horizontal line. Considering the number denoting the vertical line as the first number and the number denoting the horizontal line as second number, we can represent the school thus; (9 , 5). 9 stands for 9th vertical line; 5 stands for 5th horizontal line. (9,5) points their meeting point.

## Exercise 7-3

Find the position in each case using the previous graph :

(i) Post office (ii) Police station (iii) Hospital (iv) College (v) Park (vi) Library (vii) Harbour.

Now let us discuss the method of plotting of points as a two dimensional graph. Let us take two number lines which are perpendicular to each other. The plane they form is called **Number Plane.** Using this we can represent pairs of numbers. The number line which represents the first numbers of the number pairs is called the X Axis. The number line which represents the second numbers of the number pairs is called the Y Axis.

The first number is called the X **co-ordinate and the second** number is called the **Y co-ordinate.**

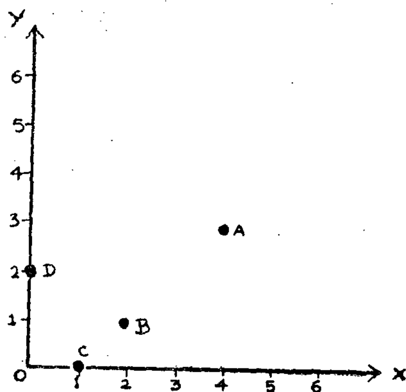



**Fig. 7-8**

**In the above figure,**

| **Point** | — | **co-ordinate** |
|---|---|---|
| **A** | | **(4,3)** |
| **B** | | **(2,1)** |
| **C** | | **(1,0)** |
| **D** | | **(0,2)** |
| **O** | | **(0,0)** |

**Method of marking the point A :**

The co-ordinates of A are (4,3), First take 4 units on the X axis. From that position, proceed 3 units vertically. Mark this point as A. Similarly, you can plot B, C, D and O (O is the origin).

## Exercise 7-4

1. Plot each of the points in a graph sheet :

   (7, 4), (3, 0), (8, 6), (0, 2), (7, 1)

2. Read the following pairs of numbers from the graph :

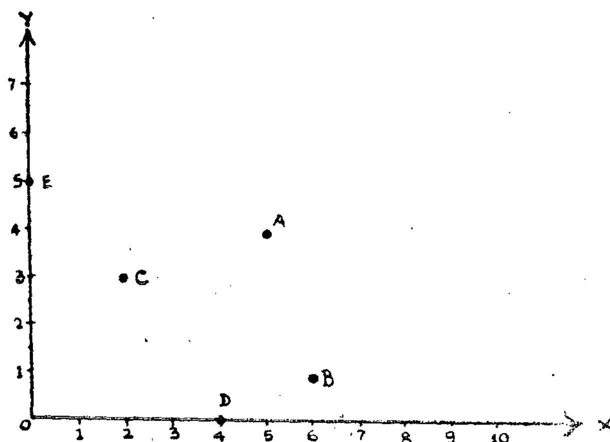
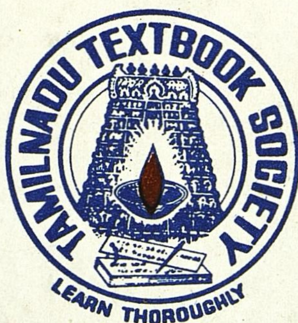



Fig 7-9.




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